172 FOX VALLEY ROAD, WAHROONGA

Flora and Fauna Assessment

For:

Johnstaff Projects

October 2014

Final

CUMBERLAND ECOLOGY

PO Box 2474
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Report No. 12093RP1

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

Revision	Date Issued	Reviewed by	Approved by	Date Approved	Revision Type
1	16Jan13	TP	TP	16Jan13	Preliminary Draft
2	22Jan13	TP	TP	22Jan13	Final
3	15Feb13	TP	DR	15Feb13	Final – Amended Plans
4	19Feb13	TP	DR	19Feb13	Final – Biodiversity Statement
5	15Oct14	KW	DR	17Oct14	Final – amended plans

Approved by:	David Robertson
Position:	*Director*
Signed:	David Robertson
Date:	*20 October, 2014*

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Executive Summary

S1 Introduction

Cumberland Ecology Pty Ltd has been engaged to prepare a Flora and Fauna Assessment for the proposed redevelopment of land located at 172 Fox Valley Road, Wahroonga NSW (the subject site). The land falls within a broader area known as "Wahroonga Estate" (the subject land) and forms part of the Seventh Day Adventist Hospital.

The proposed development involves the demolition of the existing two buildings and the construction of three buildings and car parking in their place. The proposed buildings will be up to four stories in height, and will contain an underground car park.

S2 Methods

A flora and fauna study of the subject land has previously been undertaken by Conacher Travers in 2004 and Cumberland Ecology in 2008. Additionally, Sinclair Knight Mertz (SKM) undertook vegetation mapping studies on the subject land as part of the approval process in 2009. Information on vegetation community mapping, and species recorded, particularly threatened species was extracted from these studies for use in this report.

A vegetation survey was undertaken on the 20th of December, 2012. The purpose of the survey was to ground truth the vegetation mapping undertaken by SKM in 2009 and to conduct targeted threatened flora surveys. The survey was conducted in accordance with the (then) DEC Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (Working Draft) (DEC (NSW) 2004). The survey involved the following:

- Random meander surveys to detect flora species across the subject site and to ground-truth existing mapping;
- Targeted searches for threatened flora known or considered likely to occur within the subject site; and
- Targeted searches for endangered ecological communities (EECs) known or considered likely to occur within the subject site.

At the same time as the vegetation survey, a fauna survey and habitat assessment was undertaken across the subject site. More detailed fauna trapping surveys were not considered necessary as extensive fauna surveys have previously been undertaken in the subject land, and the faunal diversity is considered to be well understood.

S3 Results

The vegetation within the subject site varies in condition, with remnant native vegetation to the east of the site existing as a managed APZ, and the remainder of the site existing as mown grassland and managed garden. The following vegetation communities were identified on the subject site:

- Sydney Turpentine - Ironbark Forest (STIF); and
- Cleared Land with Scattered Trees.

STIF is listed as an EEC under the TSC Act and as a Critically Endangered Ecological Community (CEEC) under the EPBC Act.

79 flora species were recorded on the subject land, of which 32 were exotic. Exotic species cover a significant area of the site, especially within the cleared and developed areas.

Vegetation within and adjacent to the subject site was found to provide potential habitat for a range of native vertebrate fauna species, including birds, terrestrial and arboreal mammals, bats and reptiles. A range of fauna habitats are present throughout the broader subject land, and include:

- Fruit, nectar and seed producing trees and shrubs;
- Creek and drainage lines with associated aquatic habitats;
- Rocky overhangs, platforms with exfoliated rock and rock crevices;
- Moderately dense to dense understorey;
- Moderately dense to dense groundcover;
- Leaf litter and fallen logs;
- Hollow-bearing trees;
- Cleared mown areas and planted gardens;
- Buildings; and
- Refuse.

Although not recorded during the current field surveys, the following threatened species have been detected within the subject lands during previous surveys:

- Powerful Owl (*Ninox strenua*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*); and

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*).

In addition to those species recorded from the subject land, the following threatened species are considered to have potential to utilise foraging habitat within the subject site:

- Barking Owl (*Ninox connivens*)
- Little Lorikeet (*Glossopsitta pusilla*);
- Swift Parrot (*Lathamus discolor*);
- Regent Honeyeater (*Anthochaera phrygia*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Large-eared Pied-bat (*Chalinolobus dwyeri*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*);
- Southern Myotis (*Myotis macropus*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*);and
- Eastern Free-tail Bat (Mormopterus norfolkensis).

S4 Impact Assessment

Ten trees will be removed as a result of RMS road widening, and will be assessed under a separate impact assessment. A further eleven trees will be removed to allow for the construction the proposed development. Of those, three are diagnostic canopy species of STIF, including *Syncarpia glomulifera* (Turpentine), *Eucalyptus pilularis* (Blackbutt) and *Pittosporum undulatum* (Native Daphne). A further two *Syncarpia glomulifera* (Turpentine), may be impacted in the future through incursion into their Tree Protection Zones. These trees comprise a canopy area of approximately 60 m^2, which equates to 0.006 ha, and occurs on the degraded boundary of a large vegetation patch. The removal of this tree is not considered to constitute a significant impact to the STIF C/EEC.

Additional indirect impacts have the potential to occur if not mitigated appropriately. These include changes to hydrology, alteration of light regimes and an increase in edge effects on the vegetation.

The removal of the small area of fauna habitat for the project is not considered likely to have a significant impact on any threatened species occurring on the site, or with potential to occur on the site. The removal and modification of approximately 0.05 ha of habitat is not considered significant considering the amount of similar habitat present in adjacent areas and reserved in national parks within the locality.

S5 Mitigation

A range of mitigation measures are proposed to avoid both on and off-site impacts. These include erosion and sediment control to avoid stormwater and sediment runoff, the implementation of on-site water detention measures to minimise long term downslope impacts, pre-clearance surveys to relocate any fauna present, signage to ensure that no unnecessary clearing occurs, and protection of trees to be retained through fencing.

S6 Conclusion

No significant impact is predicted to occur to threatened species or C/EECs as a result of the development, and the preparation of a Species Impact Statement (SIS) is not warranted.

Chapter 1

Introduction

1.1 Purpose

Cumberland Ecology Pty Ltd has been engaged to prepare a Flora and Fauna Assessment and Biodiversity Statement for the proposed redevelopment of land located at 172 Fox Valley Way, Wahroonga NSW (the subject site). The land falls within a broader area known as "Wahroonga Estate" (the subject land) and forms part of the Seventh Day Adventist Hospital.

The objectives of this report are to:

- Describe and map the vegetation communities on the subject site;
- Describe fauna habitats and fauna usage of the subject site;
- Assess the likelihood of threatened species as listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) occurring on the subject land;
- Formally assess the impacts of the proposed development in terms of the Director General's Requirements issued for the assessment of the project under Part 5a of the Environmental Planning and Assessment Act 1979;
- Recommend mitigation measures to reduce the impacts of the proposed development on flora and fauna; and
- Assess the proposed development's consistency with the approved Biodiversity Management Plan (Cumberland Ecology, 2010).

1.2 Site Description

1.2.1 Location

The subject site occurs to the north-east of the intersection of The Comenarra Parkway and Fox Valley Way in Wahroonga, NSW (shown in **Figure 1.1**). The subject site is approximately 0.68 ha in size. The subject site is bounded to the east by remnant native vegetation and to the north, west and south by existing development. The subject site contains two buildings

and is currently utilised as an aged care facility. The current land uses on the subject land include; the Sydney Adventist Hospital; Adventist Church Regional Headquarters and administration offices; Seventh-day Adventist Churches; a primary school; medical practices; Normanhurst Adventist Retirement Village and staff housing. A large portion of the subject land is currently undeveloped.

1.2.2 Zoning

The subject site occurs within an area currently zoned as B1 (Neighbourhood Centre). The zoning of the adjacent vegetation is E2 (Environmental Conservation).

1.2.3 Soils and Topography

The subject site occurs within the Glenorie soil landscape. This landscape occurs along the ridgeline following Fox Valley Road. The form of this landscape is undulating to rolling low hills on Wianamatta Group Shales. Soils are shallow to moderately deep (<100 cm) Red Podzolic soils on crests; moderately deep (70-150cm) Red and Brown Podzolic soils on upper slopes; deep (>200cm) Yellow Podzolic soils on upper slopes and Humic Gleys, Yellow Podzolic Soils and Gleyed Podzolic soils along drainage lines(Chapman and Murphy 1989) .

The site elevation varies between 160 and 170 metres Australian Height Datum (AHD) with slopes generally 0 – 10^{o}, generally sloping from west to east.

1.2.4 Hydrology

The subject land slopes away from Fox Valley Road and The Comenarra Parkway. The subject site has an easterly aspect and drains into Fox Valley Creek. This creek is a tributary of the Lane Cove River.

A stormwater pipe currently discharges water into the Asset Protection Zone (APZ) to the east of the extant buildings.

1.3 Proposed Development

The proposed development involves the demolition of the existing two buildings and the construction of three buildings and associated infrastructure in their place (see **Figure 1.2**). The proposed buildings will be up to four stories in height, and will contain an underground car park.

The proposed development will be located within the existing cleared footprint of the site with the exception of several trees that are proposed to be cleared for the construction of the underground car park access. Additionally, understory and small tree clearing is proposed to occur within the APZ to the east of the site to facilitate access for the construction of the development.

An assessment of the development's consistency with the approved BMP can be found in **Appendix D** of this report.

1.4 Terminology

The following terminology is used throughout the report:

- BMP abbreviates the approved Biodiversity Management Plan for the Wahroonga Estate, prepared by Cumberland Ecology;
- Subject site is defined as the parcel of land on which development is proposed, located at 172 Fox Valley Way, Wahroonga, NSW;
- Subject land refers to the total parcel of land owned by the Seventh Day Adventist Church, "Wahroonga Estate";
- Study area refers to the subject land and immediate surrounds that may be indirectly affected by the proposal;
- Locality refers to the land within a 5km radius of the subject site;
- TSC Act abbreviates the *Threatened Species Conservation Act 1995*;
- EPBC Act abbreviates the *Environment Protection and Biodiversity Conservation Act 1999*;
- EP&A Act abbreviates the *Environmental Planning and Assessment Act 1979*; and
- Threatened species refers to those flora and fauna species listed as vulnerable, endangered or critically endangered under the TSC Act or EPBC Act.

Coordinate System: MGA Zone 56 (GDA 94)

Legend

- Subject Site
- Subject Land
- Waterway

Grid North

Image Source:
Nearmaps dated 20/09/2012

Data Source:
© Copyright Commonwealth of Australia
(Geoscience Australia) 2006

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100 0 100 200 300 400 m

I:\...\12093\Figures\FFA_20141016\Figure 1.1. Location

Figure 1.1. Location of the Subject Site

Coordinate System: MGA Zone 56 (GDA 94)

Legend

- Subject Site
- Subject Land
- Development Footprint
- Waterway

Grid North

Image Source:
Nearmaps dated 20/09/2012

CUMBERLAND ECOLOGY

I:\...\12093\Figures\FFA_20141016\Figure 1.2. Development Proposal

Figure 1.2. Layout of the Proposed Development

10 0 10 20 30 40 m

Chapter 2

Methods

2.1 Literature Review and Database Analysis

A flora and fauna study of the subject land has previously been undertaken by Conacher Travers in 2004 and Cumberland Ecology in 2008. Additionally, Sinclair Knight Mertz (SKM) undertook vegetation mapping studies on the subject land as part of the approval process in 2009. Information on vegetation community mapping, and species recorded, particularly threatened species was extracted from these studies for use in this report.

The vegetation mapping of the Sydney 1:100,000 map sheet (Benson and Howell 1994) was used to determine the vegetation communities that occurred on the subject land and to standardise the vegetation community names that have been used in this report.

The Atlas of NSW Wildlife and the EPBC Act Protected Matters Search Tool were consulted for records of threatened flora and fauna species and endangered ecological communities listed under the TSC Act and EPBC Act respectively. The Atlas of NSW Wildlife search included all records within the Ku-ring-gai LGA and the EPBC Act Protected Matters search included all protected matters that may occur in a 10km radius.

The following documents were reviewed to inform this assessment:

- Ku-ring-gai Council (2010) *Guidelines for Development Activities*;
- Ku-ring-gai Council (2012) *Pre-development Application Meeting Minutes: PRE0073/12 (185 Fox Valley Road, Wahroonga, NSW, 2076)*;
- Urbis (2010) *Wahroonga Estate Redevelopment Final Preferred Project Report and Concept Plan*;
- TreeIQ (2014) *Arboricultural Impact Assessment Tree Protection Specification – 172 Fox Valley Road Wahroonga*
- MBMO (2014) *Site Plan 12008 DA 09*;
- Cumberland Ecology (2009) *Flora and Fauna Assessment for a Part 3A Assessment for the Proposed Redevelopment of "Wahroonga Estate"*;

- Sinclair Knight Merz (2009) *Wahroonga Estate Redevelopment Ecological Assessment Report*;

2.2 Flora Survey

A flora survey was undertaken on the 20th of December, 2012. The purpose of the survey was to ground truth the vegetation mapping undertaken by SKM in 2009 and to survey the flora species present. The survey was conducted in accordance with the (then) DEC Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (Working Draft) (DEC (NSW) 2004). The survey involved the following:

- Random meander surveys to detect flora species across the subject site and to ground-truth existing vegetation mapping;
- Targeted searches for threatened flora known or considered likely to occur within the subject site; and
- Targeted searches for endangered ecological communities (EECs) known or considered likely to occur within the subject site.

The relative abundance of flora species within each transect was approximated using a relative abundance scale. This scale defines species as rare to common, based on their relative abundance to other species in the transect. The flora survey locations are shown in **Figure 2.1**.

Within the transects, all vascular flora species present were identified to species level where possible, and recorded. All vascular plants recorded or collected were identified using keys and nomenclature provided in Harden (Harden 1990-1993). Where known, taxonomic and nomenclatural changes have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2011).

2.3 Fauna Survey

2.3.1 Fauna Searches

As the site has been studied previously, detailed fauna trapping surveys were not considered necessary during the field survey in December, 2012.

An active search for fauna species was undertaken by two ecologists during the field survey, which included the inspection of potential amphibian and reptile habitat. All fauna species observed or heard calling were recorded and added to the species list for the site.

Fauna surveys previously undertaken within the study area include:

- Nocturnal spotlighting;
- Bat echolocation call detection;

- Arboreal and terrestrial mammal trapping using Elliott Type A & B traps and cage traps;
- Arboreal and terrestrial mammal habitat searches;
- Habitat tree assessment;
- Amphibian searches;
- Reptile searches;
- Playback of recorded owl calls; and
- Diurnal and nocturnal bird surveys.

2.3.2 Habitat Assessment

Fauna habitat assessments were undertaken in conjunction with flora surveys during the field survey. Fauna habitat assessments included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as creeks and soaks. An assessment of the structural complexity of vegetation, the age structure of the forest and the nature and extent of human disturbance throughout the subject land was also undertaken and considered. Structural features considered included the nature and extent of the understorey and ground stratum, extent of canopy and flowering characteristics.

Hollows were used as a general indication of habitat quality for arboreal fauna, and hollow dwelling birds and bats. Hollows observed during surveys were noted and details of the size and type were recorded. Additionally, artificial habitat for hollow dwelling fauna (such as cracks in building roofs and old sheds) were recorded and considered in terms of potential fauna habitat.

Indirect indicators of fauna use of the site such as droppings, diggings, footprints, scratches, nests, burrows, paths and runways were recorded. The field surveys included targeted searches for owl pellets in likely roosting habitats. An incidental list of fauna detected was maintained throughout the survey.

2.4 Limitations

2.4.1 Flora

Owing to the survey relying on a single inspection of the subject site, it was impossible to identify all species present. Some threatened species only flower at particular times of the year, and are difficult to notice when they are not flowering. The flora survey was undertaken during a single month (December), and therefore, despite targeted threatened flora species searches being undertaken, some threatened species may be present that were not recorded. Accordingly, an assessment of the likelihood of occurrence of all threatened flora species recorded in the locality was undertaken to supplement the flora

survey. Furthermore, the subject land has been the focus of numerous ecological investigations over several years (see **Section 2.1**), and the results of these investigations have been used in the preparation of this report.

Despite these limitations, it is likely that the majority of flora species have been recorded, either during surveys for this report or for previous reports, and therefore it is considered that issues including conservation significance of the flora, condition and viability of the vegetation and likely impact on native vegetation have been satisfactorily assessed.

2.4.2 Fauna

Fauna surveys relied on literature review, database analysis, analysis of previous studies on the site and fauna habitat assessment. In common with the flora surveys, the fauna surveys were undertaken in a short period of time and therefore the fauna species recorded are a "snapshot" only, of species that were active at the time. It is likely that additional species would be recorded with more survey effort. An assessment of the likelihood of occurrence of all threatened fauna species recorded in the locality was undertaken to supplement the fauna habitat assessment. Furthermore, in common with the flora surveys, the subject land has been the focus of numerous ecological investigations over several years (see **Section 2.1**), and the results of these investigations have been used in the preparation of this report. Taking into consideration all the ecological survey effort that has been spent on the subject land, it is considered that the fauna surveys were adequate, and that all threatened species with potential to occur are known and have been satisfactorily assessed.

Coordinate System: MGA Zone 56 (GDA 94)

Legend

- Subject Site
- Subject Land
- Survey Locations

Grid North

Image Source:
Nearmaps dated 20/09/2012

CUMBERLAND ECOLOGY

I:\...\12093\Figures\FFA_20141016\Figure 2.1. Survey Locations

Figure 2.1. Survey Locations

10 0 10 20 30 40 m

Chapter 3

Results

3.1 Introduction

The vegetation within the subject site varies in condition, with remnant native vegetation to the east of the site existing as a managed APZ, and the remainder of the site existing as mown grassland and managed garden. A full list of flora and fauna species identified on the subject site is provided in **Appendix A**.

Open forest vegetation to the east of the subject site is known to provide habitat for threatened owls and arboreal mammals while the denser riparian vegetation provides potential habitat for species that prefer to be near water, such as amphibians. Streams in the area flow through largely urbanised catchments; as such, the water quality in riparian areas is assumed to be quite degraded due to a high proportion of storm water runoff.

3.2 Vegetation Communities

The following vegetation communities were identified on the subject site:

- Sydney Turpentine - Ironbark Forest; and
- Cleared Land with Scattered Trees.

These communities are mapped in **Figure 3.1** and described in further detail below.

3.2.1 Sydney Turpentine-Ironbark Forest

i. Conservation status

Sydney Turpentine-Ironbark Forest (STIF) is listed as an Endangered Ecological Community under the TSC Act (named *Sydney Turpentine-Ironbark Forest*) and a Critically Endangered Ecological Community under the EPBC Act (named *Turpentine-Ironbark Forest in the Sydney Basin Bioregion*). All STIF on the subject land is considered to represent the community as listed under the TSC Act and EPBC Act.

The area of STIF directly to the east of the extant development is currently considered to be of moderate condition. The community is managed as an APZ, with a portion of it existing as cleared and mown understory with a STIF overstory. The remainder of the community further down-slope is considered to be a high quality remnant. Within this portion of the community,

native shrub and ground layers are present and the proportion of weed invasion is far lower than in other areas. This area of STIF has good connectivity to the north and east with the bushland of the subject land but is bounded by Fox Valley Road to the west and Comenarra Parkway to the south.

ii. Other vegetation mapping

This vegetation community on the subject site is considered to be consistent with Map Unit 15 – Turpentine Ironbark Forest as described by the National Parks and Wildlife Service (NSW NPWS 2002), and with the STIF community mapped by SKM (2009).

iii. Distribution in the subject land

4.8 ha of this community exists within the broader subject land (SKM, 2009). A further 2.6 ha of the community exist within APZ's within the subject land (SKM, 2009).

This vegetation community is found in close proximity to the Blue Gum High Forest on the eastern side of Fox Valley Road. Also, scattered diagnostic canopy species of the community are present in a number of locations within the school and hospital grounds, though these patches are not considered to constitute the community due to a lack of understory vegetation.

iv. Community Description

This community consisted of trees to 30 metres high with 65-70% Projected Foliage Cover (PFC). The main tree species were *Syncarpia glomulifera* (Sydney Turpentine) and *Eucalyptus paniculata* (Grey Ironbark). Shrubs were sparse to absent with *Senna pendula var. glabrata* (Senna) and *Notelaea longifolia* (Mock Olive) present. Groundcovers were observed to 0.5 metres high with PFC of 70-80%. Species present included *Ehrharta erecta* (Panic Veldtgrass), *Commelina cyanea* (Scurvy Weed), *Paspalum dilatatum* (Paspalum), *Sida rhombifolia* (Paddy's Lucerne), *Trifolium repens* (White Clover) and *Cynodon dactylon* (Common Couch).

v. Condition

The small area of STIF located within the subject site is in better condition than the other areas of this community within the broader subject land. The vegetation directly adjacent to the subject site is currently managed as an Asset Protection Zone (APZ), thus is lacking an understorey as it is managed in a fuel reduced state for bushfire protection purposes. Down-slope of this, the community contains a well developed shrub layer and a much higher proportion of native groundcovers (up to 65%). Typical weeds located within the APZ include: *Ehrharta erecta*, *Tradescantia albiflora*, *Ligustrum sinense*, *Asparagus densiflorus* and *Hedera helix*. Weed management is currently being undertaken to restore the community to a more natural condition that is somewhat representative of the original forest

The condition of this vegetation community within the broader subject land is generally poor with most areas consisting of remnant trees characteristic of the community that have been incorporated into lawns, landscaped gardens and fire protection zones. Exotic weed

invasion in these areas is high with the dominant species being *Ehrharta erecta* (Panic Veldtgrass), *Paspalum dilatatum* (Paspalum), *Sida rhombifolia* (Paddy's Lucerne), *Trifolium repens* (White Clover) and. *Pennisetum clandestinum.* In certain areas exotic weeds dominated the ground cover up to 100%. Native ground covers, where present, typically contained: *Microlaena stipoides*, *Dichondra repens*, *Oplismenus aemulus*, *Poa affinis* and *Adiantum aethiopicum*. Shrubs were sparse to absent in these areas.

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Photograph 3.1 STIF within the eastern portion of the Subject Site.

3.2.2 Cleared Land with Trees

i. Conservation status

This vegetation community does not fall under any conservation legislation.

ii. Other vegetation mapping

This vegetation community was mapped as cleared land by NPWS (2002) and as Cleared Land with Scattered Trees by Conacher Travers (Conacher Travers, 2004).

iii. Distribution in the subject land

This community occurs throughout the majority of the developed portion of the subject lands, being those areas containing occasional remnant native species, but predominantly exotic trees with an exotic understory.

iv. Community description

This community is associated with developed areas of the site and occurs over large portions of the subject site. The entire community has been disturbed by previous land clearing and associated development. Ongoing disturbances are the result of high levels of exotic plantings, mowing and weed invasion. The level of exotic weed invasion is high throughout this community.

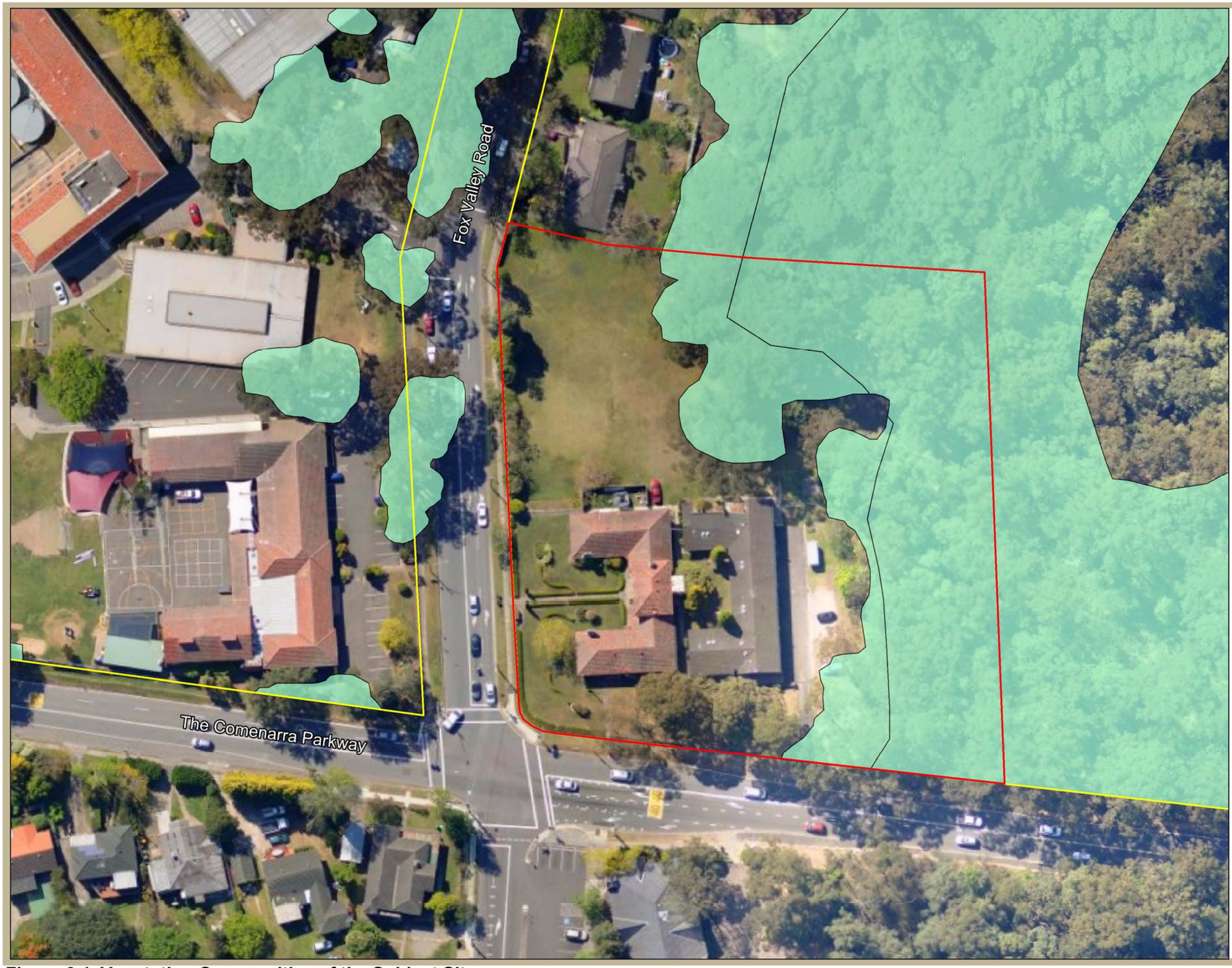
Trees, where present, exist to 25 metres in height, with a variable PFC of <5 to 15%. Species include: *Syncarpia glomulifera* (Turpentine), *Angophora costata* (Smooth-barked Apple), *Jacaranda mimosifolia* (Jacaranda) and *Eucalyptus sp.* (Planted Gum).

Shrubs include: *Pittosporum undulatum* (Sweet Pittosporum), *Nerium oleander* (Oleander Bush), *Grevillea sp.* (Grevillea) and *Callistemon sp.* (Bottlebrush); they reach 6 metres in height, with a variable <5 to 15% PFC.

The groundlayer reaches 1.5 metres high with variable 5 to 85% PFC. Common species are: *Pennisetum clandestinum* (Kikuyu), *Cynodon dactylon* (Common Couch), *Bromus cartharticus* (Prairie), *Ehrharta erecta* (Panic Veltdgrass), *Briza maxima* (Quaking Grass), *Trifolium repens* (White Clover), *Oxalis corniculata* (Yellow Wood Sorrel) and *Malva parviflora* (Small-flowered Mallow).

Photograph 3.2 Cleared land in the northern portion of the Subject Site.

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Subject Site
- Subject Land

Vegetation Community (SKM 2009)

- Sydney Turpentine Ironbark Forest

Grid North

Image Source:
Nearmaps dated 20/09/2012

Data Source:
SKM 2009 Vegetation Mapping

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10 0 10 20 30 40 m

I:\...\12093\Figures\FFA_20141016\Figure 3.1. Vegetation Communities

Figure 3.1. Vegetation Communities of the Subject Site

3.3 Flora Species

79 flora species have been recorded on the subject land, of which 32 were exotic. Exotic species cover a significant area of the site, especially within the cleared and developed areas. The total flora species list from this survey is provided in **Appendix A**

No threatened flora species have been recorded on the subject land from previous or current field surveys. Numerous threatened flora species have been detected within the locality, however these records are predominantly from the extensive areas of reserved vegetation that occur nearby, such as in Lane Cove and Ku-ring-gai National Parks. Some threatened flora records do occur within residential areas; however these appear to predominantly be in isolated patches of remnant native vegetation.

An assessment of the likelihood of further threatened flora species occurring on the subject site has been conducted and is presented in **Appendix A, Table A.1**. This assessment indicates that no threatened species are considered likely to occur. Additionally, targeted surveys were undertaken during the site inspection within the vegetated areas of the site. No threatened species were detected during this survey. As the site exists within a residential area and has been previously cleared, it is highly unlikely that any naturally occurring threatened plant species would be present on the subject site, either as viable plants or as seeds within the soil seed bank.

3.4 Fauna Habitat Assessment

Vegetation within and adjacent to the subject site provides potential habitat for a range of native vertebrate fauna species, including birds, terrestrial and arboreal mammals, bats and reptiles. Fauna habitat values of the subject site are generally associated with the areas of remnant vegetation along the eastern border of the subject site. Vegetated areas with a greater complexity in structure are likely to support a wider range of species than the communities with simple structure.

A range of fauna habitats are present throughout the broader subject land, and include:

- Fruit, nectar and seed producing trees and shrubs;
- Creek and drainage lines with associated aquatic habitats;
- Rocky overhangs, platforms with exfoliated rock and rock crevices;
- Moderately dense to dense understorey;
- Moderately dense to dense groundcover;
- Leaf litter and fallen logs;
- Hollow-bearing trees;

- Cleared mown areas and planted gardens;
- Buildings; and
- Refuse.

The subject land supports a wide variety of habitat types ranging from highly disturbed areas of low quality habitat to areas of relatively low disturbance with high quality habitat. The flower, nectar and seed producing tree and shrub species provide a seasonal foraging resource for a range of arboreal mammal and bird species. The creek and drainage lines with their associated aquatic habitats provide habitat for a number of bird, mammal, reptile and amphibian species. The cleared areas associated with the hospital provide habitat for mostly exotic bird and mammal species.

Sixty eight hollow-bearing trees were located by Cumberland Ecology within the broader subject land during surveys in 2008, adding to the 111 hollow-bearing trees recorded by Conacher Travers (2004) giving a total of 179 hollow-bearing trees recorded for the site (Cumberland Ecology, 2008). Hollow-bearing trees provide important breeding and shelter habitat for hollow-dependent arboreal mammal, hollow-dependent birds and reptile species.

The majority of the vegetation on the subject land, as well as the vegetation within the general locality provides suitable foraging habitat for a range of nectivorous species during blossom periods, with the best quality habitat within Lane Cove and Ku-ring-gai Chase National Parks. Review of the blossom periods for these canopy species indicates that there is suitable foraging habitat for these species throughout most of the year. The blossoms of the dominant tree species recorded on the subject land are known to provide a food source for a number of threatened species including the Grey-headed Flying-fox (*Pteropus poliocephalus*). Additionally, several *Allocasuarina littoralis* (Black She-oak) occur on the subject site. These trees are a known feed species for the Glossy Black-cockatoo (*Calyptorhynchus lathami*), which is known to occur within the locality.

No creeks or water bodies are located within the site, however one ephemeral drainage line does occur on the eastern boundary of the subject site. The drainage line feeds from a storm-water pipe, and may provide habitat for urban-adapted amphibian species previously detected within the subject land, such as the Striped Marsh Frog (*Limnodynastes peronii*) or Common Eastern Froglet (*Crinia signifera*).

3.5 Fauna Species

A fauna survey was conducted on the site concurrently with the vegetation survey, which recorded the following species:

- European Rabbit (*Oryctolagus cuniculus*);
- Robust Ctenotus (*Ctenotus robustus*);
- Eastern Water Skink (*Eulamprus quoyii*);

- Dark-flecked Garden Sunskink (*Lampropholis delicata*);
- Sulphur-crested Cockatoo (*Cacatua galerita*);
- Rainbow Lorikeet (*Trichoglossus haematodus*);
- Eastern Whipbird (*Psophodes olivaceus*);
- Grey Butcherbird (*Cracticus torquatus*);
- Noisy Miner (*Manorina melanocephala*);
- Australian Magpie (*Cracticus tibicen*);
- Pied Currawong (*Strepera graculina*);

The fauna species recorded during the current survey are common in the locality. A fauna species list including observation type is provided in **Appendix A**.

Previous surveys undertaken by Cumberland Ecology and Conacher Travers on the subject land detected numerous species. Three threatened species have been detected during previous surveys, including Powerful Owl (*Ninox strenua*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and the Eastern False Pipistrelle (*Fallistrellus tasmaniensis*). These surveys also detected:

- Seven mammal species;
- Three amphibian species;
- Five reptile species; and
- 44 bird species.

Results from these previous surveys can be found in **Appendix A**.

No threatened fauna species listed under the TSC Act and EPBC Act were recorded from the subject site, however several are known to occur within the subject land and the locality. An assessment of the likelihood of threatened fauna species occurring on the site has been conducted and is presented in **Appendix C, Table C.2,** and discussed in subsections below.

3.5.1 Birds

A total of seven bird species were recorded from the subject site. All species recorded are listed in **Appendix C**. The types of species recorded are those which commonly occur in and are well adapted to urban areas. Species such as the Rainbow Lorikeet (*Trichoglossus haematodus*), Noisy Miner (*Manorina melanocephala*) *and* Australian Magpie (*Cracticus tibicen*) are well adapted to urban areas, being opportunistic in both their nesting and feeding requirements. These species often compete for resources with other, less adaptable species, and are therefore considered overabundant in some areas (Parsons et al. 2006).

Numerous other bird species have been detected throughout the subject land during previous surveys. In total, 44 species were previously detected, predominantly occurring in the densely vegetated areas of the subject land. Previous surveys detected the Powerful Owl (*Ninox strenua*) within the subject lands. This species is listed as Vulnerable under the TSC Act.

Although not recorded from the subject site, the following threatened bird species have been recorded from the locality and based on the fauna habitat assessment are considered to have potential to utilise foraging habitat within the subject site:

- Barking Owl (*Ninox connivens*)
- Little Lorikeet (*Glossopsitta pusilla*);
- Swift Parrot (*Lathamus discolor*);
- Regent Honeyeater (*Anthochaera phrygia*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*); and
- Gang-gang Cockatoo (*Callocephalon fimbriatum*);

These are considered below in more detail.

i. Nectivorous Birds

Several threatened nectivorous bird species have the potential to occasionally utilise the subject site as a feed resource. This includes the Little Lorikeet (*Glossopsitta pusilla*), Swift Parrot (*Lathamus discolor*), and Regent Honeyeater (*Anthochaera phrygia*). Suitable foraging habitat for these species is present within all areas of the subject site, with numerous *Eucalyptus*, *Syncarpia* and *Corymbia* species being present across the site.

The Little Lorikeet (*Glossopsitta pusilla*) is listed as Vulnerable under the TSC Act and has the potential to forage within the subject land opportunistically during locally prolific blossom periods or when other nectar sources are scarce. The Little Lorikeet mostly occurs in dry, open eucalypt forests and woodlands and is distributed in NSW from the coast to the western slopes of the Great Dividing Range (Barrett et al. 2003). The species is considered to be nomadic (Higgins 1999), with irregular large or small influxes of individuals occurring at any time of year, apparently related to food availability where there is some tree-flowering in the vicinity (DECCW (NSW) 2010). The species uses patches of vegetation as 'stepping stones' to travel across landscapes. While not previously recorded on the subject land the species has been previously recorded within Lane Cove National Park (OEH 2012).

The Swift Parrot (*Lathamus discolor*), listed as Endangered under both the TSC Act and EPBC Act, is a predominantly nectarivorous, migratory species endemic to southeastern Australia (Birds Australia 2011). The species breeds in Tasmania and migrates to the mainland in winter, where it is most commonly found in dry, open eucalypt forests and woodlands containing Grey Box, White Box and Yellow Gum (Garnett and Crowley 2000).

The species is reliant on box-ironbark communities for winter foraging, and movement is strongly associated with the availability of lerps and winter flowering eucalypt species such as *Eucalyptus sideroxylon* (Mugga Ironbark). Swift Parrots often occur in urban areas, including farmland with remnant patches of eucalypt woodland (DEC (NSW) 2005f), (Saunders and Heinsohn 2008). Though the species has not been recorded on the subject site, suitable habitat for the species exists and it has been recorded from the broader locality.

The Regent Honeyeater (*Anthochaera phrygia*), listed as Critically Endangered under the TSC Act and Endangered under the EPBC Act, is a winter migrant confined to Victoria and NSW and is strongly associated with the western slopes of the Great Dividing Range (Garnett and Crowley 2000). The species is found in temperate eucalypt forests and woodlands, particularly in blossoming trees and mistletoe (DEC (NSW) 2006b). The Regent Honeyeater is strongly nomadic and follows blossoming trees (Franklin et al. 1989) (NSW Scientific Committee 2004f). The species uses patches of vegetation as 'stepping stones' to travel across landscapes. The species has not been recorded within the subject site, nor within five kilometres of the subject site; however it is considered to have potential to occur as suitable winter-flowering trees are available.

ii. Glossy Black-cockatoo

The Glossy Black-Cockatoo (*Calyptorhynchus lathami*) listed as Vulnerable under the TSC Act, was previously widely distributed across most of south-eastern Australia. In NSW the species now has patchy distribution along the coast and tablelands in eucalypt open forest and woodland with hollow-bearing trees and stands of she-oak species. The species feeds almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina* species). It generally nests in tree hollows of approximately 26cm wide by 1.4cm deep in live trees or stags. Pairs defend the immediate area surrounding the nest hollow and have large forage ranges. Glossy Black-Cockatoo is highly mobile and can disperse up to 12 to 60 km (NSW NPWS 1999) (NSW Scientific Committee 2004c).

The species is known to occur within the Lane Cove National Park (OEH, 2012) and is considered likely to forage within the subject site opportunistically as several feed trees are present. No nesting habitat is present in the subject site however, due to the lack of suitably large tree hollows.

iii. Gang-Gang Cockatoo

The Gang-Gang Cockatoo (*Callocephalon fimbriatum*) listed as Vulnerable under the TSC Act. In NSW, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. In summer, the Gang-gang Cockatoo occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests (Frith 1969). In winter, the Gang-gang Cockatoo occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. At this time the species may be observed in urban areas including parks and gardens. The Gang-gang Cockatoo requires hollows in the trunks or large limbs of large trees in which to breed (NSW Scientific Committee, 2005).

The Ku-ring-gai population of Gang-gang Cockatoos is listed as Endangered under the TSC Act. The population is estimated to encompass about 18 to 40 breeding pairs. The population previously occurred over the Baulkham Hills, Cherrybrook and Dural areas, however, due to heavy development in these areas the species is now restricted to the Ku-ring-gai and Hornsby LGAs. The species is regionally important being the only breeding population in the Sydney metropolitan area. Gang-gang Cockatoos have a preference in the winter months for lower altitude habitats, including dry coastal eucalypt forest and Box - Ironbark assemblages. The Gang-gang Cockatoo will usually breed in tall sclerophyll forests with large hollows and a dense understorey; breeding occasionally occurs in coastal forests

The species is known to occur within the Lane Cove National Park (OEH, 2012) and is considered likely to forage within the subject land opportunistically. No nesting habitat is present in the subject site due to the lack of suitably large tree hollows.

iv. Forest Owls

The subject site provides suitable foraging habitat for the Powerful Owl (*Ninox strenua*) and the Barking Owl (*Ninox connivens*). These species are listed as Vulnerable under the TSC Act.

The subject land contains areas of known roosting and breeding habitat for the Powerful Owl, and this species has previously been recorded. Roost habitat for this species occurs in the form of mesophyllous vegetation in riparian corridors downslope of the subject site. Additionally, a *Eucalyptus pilularis* containing a large hollow is located downslope of the subject site, and is a known nesting site for the species. The subject site is considered to provide suitable habitat for some of the owl's preferred prey species, including the Common Ring-tail Possum (*Pseudocheirus peregrinus*) although no signs of whitewash or owl pellets were recorded during the 2012 survey. The Powerful Owl has numerous records from within the locality (DECC (NSW), 2009) and has been recorded within approximately 150m of the subject site.

The Barking Owl has not been recorded in the locality of the subject site, however suitable forage habitat is present and the subject site exists within the home range of known species records (OEH 2012).

3.5.2 Mammals

Two threatened mammal species have been detected within the subject lands during previous survey: the Grey-headed Flying-fox (*Pteropus poliocephalus*); and the Eastern False Pipistrelle *(Falsistrellus tasmaniensis*). In addition to the two threatened species recorded, based on the fauna habitat assessment, the following threatened mammal species are considered to have potential to utilise foraging habitat within the subject site:

- Large-eared Pied-bat (*Chalinolobus dwyeri*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*);
- Southern Myotis (*Myotis macropus*);

- Greater Broad-nosed Bat (*Scoteanax rueppellii*);and
- Eastern Free-tail Bat (*Mormopterus norfolkensis*).

Some small tree hollows exist on the subject site, thus have the potential to provide habitat for hollow dependant threatened microchiropteran bat species such as the Eastern Free-tail Bat (*Mormopterus norfolkensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and the Eastern False Pipistrelle (*Fallistrellus tasmaniensis*). Commonly occurring non-threatened species, such as Gould's Wattled Bat (*Chalinolobus gouldii*) and have been detected during previous surveys Microchiropteran bats would also be attracted to the subject site as levels of insect activity are likely to be high due to the flood lights present.

One invasive exotic mammal species, the European Rabbit (*Oryctolagus cuniculus*) was recorded during the current survey. Several individuals were detected on the boundary of remnant vegetation and cleared grassland within the site.

Species previously observed within the subject land include native and introduced mammals, which would use the subject site from time to time. Such fauna would include the introduced Black Rat (*Rattus rattus*), and the native Common Brushtail Possum (*Trichosurus vulpecula*).

The threatened mammal species recorded from the subject land or with potential to occur are considered below in more detail.

i. Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as Vulnerable under the TSC Act and EPBC Act. The species inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests as well as cultivated and urban areas. The subject site supports a number of species which are suitable feed trees for the Grey-headed Flying-fox. These include trees from the Fabaceae, Myrtaceae and Pittosporaceae families.

Whilst the subject site provides suitable foraging habitat for this species no roosting habitat is present on it. The Grey-headed Flying-fox roosts in colonies known as "camps". Bats have high site fidelity for camps and disperse between camps depending on the availability of food. In the Sydney area, there are three major Grey-headed Flying-fox camps; at Ku-ring-gai Flying-fox Reserve at Gordon adjacent to Garigal National Park, the Royal Botanic Gardens, and Cabramatta Creek Flying-fox Reserve at Cabramatta (Ku-ring-gai Council 1999). The Gordon camp is within close proximity to the subject land and there have been many sightings of the Grey-headed Flying-fox throughout the locality (OEH, 2012) including within Lane Cove National Park.

Large numbers of this species were observed on the subject site by Conacher Travers during their survey in 2004. No estimation of numbers was provided in the report, nor were details of numbers of the individuals feeding or flying over the site provided. The species was observed flying in to the site from the east and feeding on the nectar of the flowering eucalypt tree species within the subject land. The Grey-headed Flying-fox was also recorded by Cumberland Ecology during surveys in 2008.

ii. Microchiropteran Bats

Conacher Travers detected the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) via echolocation call recording during Anabat surveys conducted in November 2003 (Conacher Travers, 2004) within the vicinity of Coups Creek. No other threatened microchiropteran bats have been detected within the subject land, however several species have the potential to utilise the site. Suitable foraging habitat is provided across the subject land, with suitable roosting habitat for hollow-dwelling microbats available within the hollow-bearing trees throughout the subject land. Several hollow bearing trees also occur within the subject site. Species considered to have potential to occur on the subject site include the Large-eared Pied-bat (*Chalinolobus dwyeri*), Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Eastern Free-tail Bat (*Mormopterus norfolkensis*).

The Large-eared Pied-bat (*Chalinolobus dwyeri*) is generally rare with scattered records in NSW. It is listed as Vulnerable under the TSC Act and EPBC Act. One record of the species exists in the Ku-ring-gai LGA from 1992 (DECC (NSW), 2008). It roosts in caves (near their entrances), crevices in cliffs and old mine workings. Found in well-timbered areas containing gullies, the species frequents low to mid-elevation dry open forest and woodland close to roosting sites. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years.

The Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) occurs along the east and north-west coasts of Australia. It roosts in caves, derelict mines, stormwater tunnels, buildings and other man-made structures. It forages above the canopy in forested areas. This species also can potentially roost in some rock crevices and overhangs (DECC (NSW) 2005). The Eastern Bentwing-bat forms maternity colonies in caves and populations usually centre on such caves (DECC (NSW) 2005). The Eastern Bentwing-bat is listed as Vulnerable on Schedule 2 of the TSC Act (NSW Scientific Committee 2004b). There are 21 records of this species within the Ku-ring-gai LGA.

The Eastern Freetail Bat (*Mormopterus norfolkensis*) occurs from southern Queensland to southern NSW, in dry sclerophyll forest and woodland. It roosts in tree hollows and sometimes under bark or in man-made structures (DEC (NSW) 2005b). The Eastern Freetail Bat is listed as Vulnerable on Schedule 2 of the TSC Act (NSW Scientific Committee, 2004c)(DEC (NSW) 2005b). There are 7 records of this species within the Ku-ring-gai LGA. There are 7 records of this species within the Ku-ring-gai LGA.

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. The species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings (OEH, 2012). The Greater Broad-nosed Bat is listed as Vulnerable on Schedule 2 of the TSC Act. There are three records of this species within the Ku-ring-gai LGA.

3.5.3 Reptiles

No threatened reptile species have been recorded from the subject land. The common skink species *Lampropholis delicata* was recorded on the subject site. It is likely that other common reptile species occur on the subject site, however none were detected during an active search of the site. Potential reptile habitat exists in the form of logs and stick mounds, as well as disused buildings and building materials.

Although not recorded within the subject land, a habitat assessment concluded that sub-optimal habitat exists on the subject site for Rosenberg's Goanna (*Varanus rosenbergi*) and the Broad-headed Snake (*Hoplocephalus bungaroides*). Rosenberg's Goanna requires terrestrial termite mounds for nesting and these were not observed on the subject land (Cumberland Ecology, 2008), while the Broad-headed Snake requires rocky escarpments as shelter habitat, none of which are present within the subject land. The subject land does not offer significant habitat to these species and it is unlikely these species are present on the subject site.

3.5.4 Amphibians

Three amphibian species were recorded during previous surveys of the subject land. None were recorded during the current survey of the subject site. No threatened amphibian species have been recorded from the subject land during present or previous surveys.

Two threatened amphibian species are known to occur in the locality, the Green and Golden Bell Frog (*Litoria aurea*), listed as Endangered under the TSC Act (1995) and Vulnerable under the EPBC Act (1999) and the Red-crowned Toadlet (*Pseudophryne australis*), listed as Vulnerable under the TSC Act (1995). A habitat assessment has been undertaken for these two species which determined that there was no suitable habitat for either of these species on the subject site. No habitat for the Green and Golden Bell Frog is present, as there are no permanent water bodies on the subject site. One ephemeral drainage line does occur on the eastern boundary of the subject site. The drainage line feeds from a storm-water pipe, and is not considered to constitute suitable habitat for Red-crowned Toadlet (*Pseudophryne australis*). The species has not been recorded breeding in waters that are even mildly polluted, and are restricted to the immediate vicinity of their breeding habitat (DEC (NSW) 2005e), thus the site is not considered to constitute suitable habitat for threatened frog species.

Chapter 4

Impact Assessment

4.1 Direct Impacts

4.1.1 Impacts on Native Vegetation

Ten trees are proposed be removed for road widening purposes, and are to be assessed under a separate impact assessment. Eleven trees will be removed to allow for the construction of the proposed development (TreeIQ, 2014). Of the eleven trees proposed for removal, three are native. Of those, three are diagnostic canopy species of STIF, including *Syncarpia glomulifera* (Turpentine), *Pittosporum undulatum* (Native Daphne) and *Eucalyptus pilularis* (Blackbutt). Additionally, two *Syncarpia glomulifera* (Turpentine) have the potential to be impacted in the longer term through incursion into their Tree Protection Zones (TPZ). The tree comprises a canopy area of approximately 60 m^2, which equates to 0.006 ha, and occurs on the degraded boundary of a large patch of vegetation. The remainder are planted native and exotic species which do not naturally occur in vegetation communities within the locality. . The removal of these trees is not considered likely to impact on the long term viability of STIF within the subject land or the locality. A total of approximately 0.05 ha of vegetation is proposed to be removed.

The eleven trees proposed to be removed include the following species:

- Tree 28 – *Jacaranda mimosifolia* (Jacaranda);
- Tree 48 – *Prunus armeniaca* (Apricot);
- Tree 49 – *Pittosporum undulatum* (Native Daphne);
- Tree 50 – *Syncarpia gloumlifera* (Turpentine);
- Tree 66 – *Eucalyptus pilularis* (Blackbutt);
- Tree 74 – *Melia azerdara*ch (White Cedar);
- Tree 76 – *Jacaranda mimosifolia* (Jacaranda);
- Tree 89 – *Lagunaia patersonia* (Native Hibiscus);
- Tree 90 – *Grevillea robusta* (Silky Oak);
- Tree 91 – *Callistemon viminalis* (Weeping Bottlebrush); and

- Tree 92 – *Grevillea robusta* (Silky Oak).

Ten trees (trees 29, 30, 31, 32, 33, 75, 79, 80, 81, and 88) are proposed to be removed as part of RMS road widening works along the Comenarra Parkway. It is understood that the road-widening works will be subject to a separate impact assessment completed by the Roads and Maritime Authority (RMS).

Minor encroachment into the Tree Protection Zone (TPZ) of a number of trees has been identified by the Project Arborist. These impacts are considered negligible and are not considered likely to impact the health of the tree. This encroachment will be compensated by expansion of the TPZ, as per the recommendations in *Australian Standard 4970-2009 Protection of Trees on Development Sites* (AS4970). Trees which will undergo minor encroachment include trees 35, 40, 51, 52, 55, 56, 69, 95 and 96.

Major encroachment is considered to occur to trees 34, 35, 40, 51, 52, 55, 56 and 58. It is understood that these impacts can be minimised through the implementation of mitigation measures such as retention of topsoil, retention of roots over 25mm in diameter, covering of exposed roots in jute mat and exclusion of machinery from TPZ's.

Two additional trees are considered to have major encroachment which may lead to a long term decreased in the health of these trees. Trees 63 and 65 (both *Syncarpia glomulifera*, Turpentine) will have major encroachment into their root zones by basement construction, and through the installation of a new stormwater pipe. It is understood that the impacts to these trees will be managed through the construction period so as to avoid all possible impacts, predominantly through avoidance of major roots. Additionally, a shotcrete wall has been designed to ensure minimal excavation is required. Pipe installation will use a thrust-boring technique to minimise impact to major roots. As there is potential for these trees to be impacted in the longer term, the potential impacts to these trees have been included within this impact assessment.

Additional indirect impacts have the potential to occur if not mitigated appropriately. These include changes to hydrology, alteration of light regimes and an increase in edge effects on the vegetation.

The removal of the small area of fauna habitat for the project is not considered likely to have a significant impact on any threatened species occurring on the site, or with potential to occur on the site. The removal and modification of approximately 0.05 ha of habitat is not considered significant considering the amount of similar habitat present in adjacent areas and reserved in national parks within the locality.

The main impact from the proposed development will be the clearing of vegetation. The 'Clearing of Native Vegetation' is listed as a Key Threatening Process (NSW Scientific Committee, 2004) and has been identified as a direct cause in the decrease in biodiversity. As a result of the proposed development the subject site will experience a reduction in the extent of native vegetation, however the patch will not become fragmented as a result of this clearing, as the trees occur along the boundary of the patch. Additionally, under scrubbing of an area of vegetation within the Asset Protection Zone will occur, to facilitate an access

track to the construction area throughout the construction period. The number of trees requiring removal for this process is not known at this stage.

This clearing is considered to be very minor in the context of large areas remaining in the subject land outside of the subject site, and in reserves in the locality. As discussed above, the majority of the trees to be removed have been planted, and do not occur naturally in this area. An Assessment of Significance has been undertaken to assess the significance of the impact to the STIF EEC. This assessment can be found in **Appendix D**, and concludes that as the scale of clearing is minor, there will be no significant impact to the long-term viability of the STIF EEC within the subject site or broader locality.

4.1.2 Impacts to Fauna

The clearing of eleven trees across the subject site is not considered likely to impact on fauna usage of the subject site or within the locality. The trees identified for removal may be utilised sporadically by mobile fauna species, however they do not represent important habitat. The quality of the extant habitat within the subject site is marginal, already being impacted by light and noise from adjacent land uses such as roadways and buildings. As such, the removal of several trees of marginal habitat quality is unlikely to result in impacts to threatened fauna utilising the subject land.

The impact of clearing on the threatened fauna species that have been recorded or are likely to occur on the subject site is outlined below.

i. Forest Owls

Suitable foraging habitat is present on the subject site for the Barking Owl (*Ninox connivens*) and Powerful Owl (*Ninox strenua*). Research indicates that Powerful Owls and the other forest owls occupy very large home ranges (DEC (NSW), 2006). Given the large area of native forest remaining in the study area, the clearing of a small area (0.05 ha) of native vegetation on the subject site will have minimal impact on foraging territories of the owls, and no significant impact on the species.

ii. Nectivorous Birds

Nectivorous birds considered to have potential to utilise the subject site as forage habitat include the Little Lorikeet (*Glossopsitta pusilla*), Swift Parrot (*Lathamus discolor*), and Regent Honeyeater (*Anthochaera phrygia*). The subject site contains winter flowering eucalypts, and therefore provides some suitable foraging habitat for this species. The removal of 0.05 ha of habitat is not likely to cause a significant impact to the long-term survival of these species. Flowering trees will be retained within the subject site and subject land, and the vegetation will not be fragmented as a result of the proposal.

iii. Gang-gang Cockatoo (Callocephalon fimbriatum)

Suitable foraging habitat exists for this species on the subject site. The proposed development will remove a small area of potential foraging habitat for this species. The habitat of the subject site is not considered to be significant to the viability of this species and

large tracts better quality habitat are available in nearby Lane Cove and Ku-ring-gai Chase National Parks, in addition to the remnant vegetation occurring to the east of the subject site. The proposed development will not impact on this species at a local or regional scale as the extent of potential foraging habitat that occurs on the subject site is extremely limited.

iv. Glossy Black Cockatoo (Calyptorhynchus lathami)

Some suitable foraging habitat exists for this species on the subject site, in the form of *Allocasuarina littoralis* (Black She-oak), a known feed tree for the species. The proposed development will not remove any potential foraging habitat for this species, as no individuals of this tree species are proposed for removal. The habitat of the subject site is not considered to be significant to the viability of this species and large tracts of equivalent and better quality habitat are available in nearby Lane Cove and Ku-ring-gai Chase National Parks. The proposed development will not impact on this species at a local or regional scale as no feed trees are to be removed.

v. Other Threatened Birds

No suitable forage, nesting or roosting habitat occurs within the subject site for other threatened bird species.

vi. Bats

a. Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox (*Pteropus poliocephalus)* is listed as Vulnerable under the TSC Act and EPBC Act. Whilst the subject land provides suitable foraging habitat for this species no camps were observed or are known to occur on it.

The Grey-headed Flying-foxes observed on the subject land by Conacher Travers are likely to have flown in from the Flying-fox Reserve at Gordon. Local populations do not exist as such due to the migration of individuals over large distances within their range in response to food availability. Flying-fox numbers vary greatly at camp sites throughout the year because the species is nomadic (Churchill, 1998).

Based on the occasional use of the site by the species, the Assessment of Significance concluded that there will be no significant impact on the Grey-headed Flying-fox at a local or regional scale due to the alteration of foraging habitat on the subject site.

vii. Microchiropteran Bats

a. Large-eared Pied-bat (*Chalinolobus dwyeri*)

The subject site provides limited suitable diurnal roosting habitat in vegetation, but no maternal roost habitat which is found within crevices and overhangs in sandstone outcropping. Suitable foraging habitat is present in the forested gullies down-slope of the subject site, within the subject land. The vast majority of the roosting habitat and much of the best foraging habitat for this species on the subject land exists within the riparian

corridors (Cumberland Ecology, 2009). This area of the subject land is being managed under the Biodiversity Management Plan, therefore no potential roosting locations within this area will be affected by the development and the best quality areas of the foraging habitat will be retained.

An Assessment of Significance found that there is not likely to be a significant impact on the Large-eared Pied-bat at a local or regional scale due to the alteration of habitat on the subject site.

b. Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

The Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) was recorded on the subject land in surveys by Conacher Travers in 2004. The subject site provides suitable foraging and roosting habitat for this species, which will be reduced in size under the proposed development. No other records exist for this species from the Ku-ring-gai LGA (DECC (NSW), 2008) so it is considered unlikely that there is a viable population of this species present in the locality of the subject site (Cumberland Ecology, 2009). The mobility of this species will allow it to forage and roost in areas of nearby suitable habitat in Lane Cove National Park. An Assessment of Significance was conducted for the species which concluded that the proposed development is not considered likely to result in a significant impact upon this species at a local or regional scale.

c. Other Microchiropteran Bats

Other threatened microbats that could potentially use the subject land for foraging and/or roosting include: the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and the Eastern Free-tail Bat (*Mormopterus norfolkensis*).

No habitat of significance occurs on the subject site for any of these species. Although they may forage over the subject site, the area of habitat to be removed is negligible. Equivalent or better roosting and foraging habitat occurs in the large areas of surrounding native vegetation, particularly Lane Cove National Park. An Assessment of Significance was conducted for these species, and concluded that, given the mobility of these species and the limited habitat on the subject site, the development is unlikely to cause any significant impact on these species at a local or regional scale.

viii. Amphibians

A habitat assessment concluded that no suitable habitat for threatened amphibian species occurs on the subject site. Development impacts upon these species, if present, are likely to be minimal given that all suitable habitat for these species is located in the moister gullies outside the development footprint.

Any potential impacts caused by pollutants and nutrients in increased run-off from larger hardstand areas are to be managed as per the Flooding and Stormwater Management Plan (Hyder Consulting Pty Ltd, 2008).

ix. Reptiles

Sub-optimal habitat exists on the subject site for Rosenberg's Goanna (*Varanus rosenbergi*) and the Broad-headed Snake (*Hoplocephalus bungaroides*). It is considered unlikely these species are present on the subject site and subject land, as habitat for these species is limited. Therefore, the proposal is considered unlikely to cause significant impacts on these species.

4.2 Indirect Impacts

4.2.1 Impacts to Flora

There is potential for indirect impacts of the proposed development to occur on STIF on the subject site and down slope areas of the subject land. These are discussed below:

a. Hydrology

The construction of hard surfaces within the subject site has the potential to impact on soils by increasing levels of nutrients via rainwater runoff that are greater than what would occur naturally. Whilst some nutrients are more readily dispersed through soil strata, phosphorus is largely retained and can be expected to favour growth of exotics in preference to most native species. Hydrological changes have occurred on and around the site in the past due to the previous development of the subject land. The significance of existing hydrological impact within the current area of STIF has not been specifically determined or documented, however its impact on soil seems within the general limits of tolerance of numerous STIF species including Turpentine (*Syncaripa glomulifera*).

As the existing and proposed development will occur upslope of the STIF, the vegetation will continue to receive elevated nutrients in overland rainwater and subsurface flows. A *Flooding and Stormwater Master Plan* (Hyder Consulting Pty Ltd, 2008) has been approved for the redevelopment of the Wahroonga Estate by Hyder Consulting Pty Ltd. This document details requirements for on-site retention, detention of stormwater, roof, surface drainage, subsoil drainage and stormwater quality control (in accordance with Ku-ring-gai Council's requirements) and outlines projected nutrient and pollutant loads expected in each of the sub-catchments on the subject land. A Civil Design Report has been prepared by TaylorThompsonWhitting (TWW) (2014) which incorporates the designs set out in the master plan, and includes the construction of a detention basin to store and gradually release storm water. The location of the stormwater outfall point has been situated so as to minimise impacts to the downslope vegetation. These measures, together with the sediment and erosion control measures implemented during construction, will assist in the prevention of excess water reaching the STIF.

Increased levels of runoff from stormwater could result in increased weed invasion through seed transferral within stormwater as well as increased nutrient levels. Weed dispersal will be limited by limiting stormwater runoff through measures outlined in the Hyder Consulting report (Hyder Consulting Pty Ltd, 2008) and through the Civil Design Report prepared by TWW (2014) . Weed levels within the retained vegetation, including EECs, will be managed

and monitored as specified in the in the approved Biodiversity Management Plan (BMP) (Cumberland Ecology, 2009).

b. Altered light regimes

The proposed development will alter the current light regime within the STIF through either overshadowing from buildings or increased light from clearing. Both of these effects have the potential to result in a change in species composition within communities as light sensitive or light dependent species die out from over- or under-exposure. This may result in more robust, opportunistic weedy species dominating the affected area. These issues will be managed and monitored in accordance with the approved BMP.

c. Edge Effects

The impacts of edge effects on vegetation are currently evident throughout the subject land with weed invasion and signs of human disturbance common. There is potential for such disturbances and weed invasion to impact larger areas of the subject land under the proposed development which could degrade the quality of the vegetation further. Mitigation measures employed to ensure that these kinds of impacts do not occur following the proposed development include proposed aesthetic fencing around the EECs and further mitigation measures to be included in the approved BMP. Mitigation measures within the BMP include: weeding, revegetation, control of inappropriate fire regimes, precautions against *Phytophthora*,

4.2.2 Impacts to Fauna

The project has potential to result in indirect impacts on fauna species detected within the subject site, subject land, and in the locality of the proposed development. These potential impacts are discussed below.

a. Hydrology

As discussed previously, the construction of hard surfaces within the subject site has the potential to impact on downslope hydrology by increasing levels of nutrients via rainwater runoff that are greater than what would occur naturally. Hydrological changes have occurred on and around the site in the past due to the previous development of the subject land. The significance of existing hydrological impact downslope of the subject site is not known, however it can be assumed that the current level of impact is outside the pollution tolerance level of species which use ephemeral drainage lines as habitat, such as the Red-crowned Toadlet (*Pseudophryne australis*).

As the existing and proposed development will continue to discharge excess storm water at this point, down-slope areas will continue to receive elevated nutrients in overland rainwater and subsurface flows. A *Flooding and Stormwater Master Plan* (Hyder Consulting Pty Ltd, 2008) has been approved for the redevelopment of the Wahroonga Estate by Hyder Consulting Pty Ltd. A Civil Design Report has been prepared by TWW (2014) which incorporates the designs set out in the master plan, and includes the construction of a detention basin to store and gradually release storm water. The location of the stormwater

outfall point has been situated so as to minimise impacts to the downslope vegetation. These measures, together with the sediment and erosion control measures implemented during construction, will assist in the prevention of excess water reaching the habitat for threatened species occurring downslope of the subject site.

b. Altered light regimes

Altered light regimes are considered unlikely to impact on threatened fauna species. Species that may potentially be impacted by altered light regimes include roosting nocturnal birds and amphibians. No amphibian habitat is present in the vicinity of the proposed development. Similarly, roosting diurnal birds are highly mobile and unlikely to utilise roost habitat close enough to the proposed development to be impacted by changes to ambient light levels.

Chapter 5

Mitigation Measures

The development will utilise avoidance and mitigation measures to minimise any potential impacts to the ecological values of the subject land as well as adjoining vegetation that may be indirectly impacted by the project. The process of avoidance and mitigation is as follows:

- Avoid: to the extent possible, developments should be designed to avoid or minimise ecological impacts; and,
- Mitigate: where certain impacts are unavoidable through design changes, mitigation measures should be introduced to ameliorate the ecological impacts of the future development.

This chapter provides recommended avoidance and mitigation measures for the proposed project.

5.1 Avoidance Measures

Avoidance of major native trees has been incorporated into the design layout. The proposed development will be located predominantly on previously disturbed and developed land, with few significant trees being removed.

The initial design (MBMO, 2012) would have required the removal of two *Syncarpia glomulifera* (Turpentine) trees. The design has been amended specifically to avoid impacts to Tree 63 (TreeIQ, 2012), a *Syncarpia glomulifera* (Turpentine), and thus the STIF EEC. This has resulted in a development footprint which requires the direct removal of only three diagnostic canopy tree of the STIF EEC.

Trees downslope of the proposed development will be retained and managed within the APZ, in accordance with the BMP. The species retained are predominantly from the family Myrtaceae, and the majority are locally endemic with different flowering periods. Many of these species flower profusely, thus the impacts to any blossom dependent threatened fauna utilising the site as a forage resource will be minimised. Additionally, many of these species form hollows over time, so the retention of these trees will increase the availability of habitat in the long term.

Avoidance measures have been undertaken to minimise impacts to the Powerful Owl (*Ninox strenua*). A pair of Powerful Owl adults and a recently fledged juvenile have been recorded roosting in the vegetation adjacent to the subject site during previous surveys. A suspected

nest hollow in a large *Eucalyptus pilularis* was located a short distance from the roost site. During the initial impact assessment for the rezoning of the Wahroonga Estate, ornithologist Dr Steven Debus was engaged to assist in determining the likelihood of impacts of the proposed development and appropriate mitigation measures to minimise these impacts.

Based on his recommendations, the proposed concept design was adjusted to allow for a 100 m buffer of native vegetation between any development and the nest tree. This 100 m buffer is considered to be an appropriate distance for the species to continue utilising the site as breeding habitat (Cumberland Ecology, 2009).

5.2 Mitigation Measures

A number of mitigation measures are recommended to be utilised for the proposed project, including those to be undertaken during the construction, operational and post-operational phases of the proposed project. It is proposed that these proposed mitigation measures be incorporated into the conditions of consent.

Recommended mitigation measures are detailed below.

5.2.1 Access, Signage and Demarcation

To avoid unnecessary removal or damage to native vegetation being retained, the development footprint should be clearly demarcated and signed, where appropriate, to ensure no vegetation beyond these boundaries is removed. Temporary fencing can be erected to ensure construction and operational activities are contained within the development footprint.

Site inductions are to be given by the civil contractor to ensure all site workers and visitors are aware of any tree protection zones and any vegetation no-go areas.

5.2.2 Erosion, Sediment and Pollution Control

As the subject site is located on sloped land, it is recommended that precautions be taken to minimise the impacts of erosion and sedimentation down the slope and to ensure that no sediment or pollution enters adjoining vegetation. To reduce sedimentation on the construction site, erosion control measures will be implemented. This includes minimising the amount of exposed soils on the site at any given time. All soil stockpiles should be adequately covered when not in use to prevent erosion from heavy rainfall. Sediment fences should be established around the perimeter of the development area to prevent the impacts of sedimentation on the adjoining vegetation. During development, precautions should be taken to ensure that no pollution, such as petrochemical substances or water containing suspended solids, escapes the construction site.

Increased pollutant and nutrient loads from storm water run-off, which could potentially reach adjacent reserves and Lane Cove National Park should be mitigated appropriately through measures such as gross pollutant traps, bioretention systems, ponds and other small scale storm water management measures, as detailed in the site specific stormwater management

plan. To prevent excess stormwater runoff flowing off the building site, barriers should be established to divert the flow of water away from the adjoining vegetation and into appropriate drainage systems. Filters should be constructed within the barriers to minimise the amount of sedimentation entering the drainage systems.

A Civil Design Report (TTW 2014) has been created for the site. This report includes designs for onsite detention of both rain and storm water, in accordance with the recommendations of Hyder (2008) and the BMP (Cumberland Ecology 2010). Additional measures include erosion and sediment controls throughout the construction, gross pollutant traps and the construction of a stormwater detention tank to store and slow the flow of excess stormwater into the adjacent vegetation..

5.2.3 Rehabilitation and Management of Trees

Trees to be retained should be effectively managed to ensure their long term habitat viability. Endemic native species should be used where possible during the landscape design phase of the development to provide habitat for native fauna species. Retained trees are to be managed during the construction phase in accordance with Section 4 Tree Protection Measures, set out in A54970-2009 The Protection of Trees on Development Sites.

5.2.4 Pre-clearance Surveys

It is recommended that pre-clearance surveys be undertaken to ensure that any fauna ethics issues are managed appropriately and to avoid impacts on resident fauna.

Prior to the clearing of any trees, a pre-clearing fauna survey will be conducted by a qualified ecologist to identify and minimise impacts to resident fauna. Any fauna utilising the area will be recorded, and where possible, these will be encouraged to leave the area.

Trees bearing hollows have potential to contain native species such as bats, gliders, possums, reptiles and birds, and any hollows present will be identified prior to any clearing activities. All trees observed to contain hollows or nests will be identified, recorded and flagged with fluorescent marking tape, and have a large (>1 m) “H” spray painted with white line marking paint on four sides of the tree. The ground around each tree will be inspected for scats, and the trees for scratch marks.

The clearing will be conducted using a two-stage clearing process. Clearing will commence following the identification of potential habitat trees by an ecologist.

- If possible, trees marked as containing hollows will be shaken by machinery prior to clearing to encourage any animals remaining to leave the hollows and move on;
- The recommended methodology is to use a cherry picker and/or arborist to remove the crown of the tree. Remove branches bearing hollows individually and hoist gently to the ground. Remove trunk in sections to allow for extra hollows. Sections of trunk and branches with hollows will be moved to an area of nearby vegetation. If possible, branches or trunk sections with hollows will be attached to another tree. If not, these are to be placed near the base of a large tree;

- If a cherry picker/ arborist is not available, use a bulldozer to start pushing the tree over. Move the bulldozer over the roots and continue gently pushing the tree over. The tree should not fall heavily to the ground. Remove branches with hollows and sections of trunk and set aside for immediate transfer; and

- An ecologist will investigate all hollows for the presence of fauna following felling of the tree.

An ecologist should be present while clearing to rescue animals injured during the clearance operation. Any fauna found will be captured and relocated to nearby remnant vegetation and released after nightfall to minimise the risk of predation by diurnal predators. Any animals that are inadvertently injured will be taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized.

All persons working on the vegetation clearing will be briefed about the possible fauna present at the time of construction, and what procedures should be undertaken in the event of an animal being injured or disturbed. A qualified animal rescue person will be on call at all times during clearing.

If sandstone boulders are to be moved during clearing, the ecologist will catch any snakes or frogs that may be sheltering under them. These animals will be relocated to suitable habitat elsewhere in adjacent vegetated areas.

5.3 EEC Specific Mitigation Measures

5.3.1 General Mitigation Measures

The site contains a large stand of variable quality (low – moderate) STIF with a native shrub and ground layer. Much of the STIF is currently undergoing management for bushfire risk reduction purposes, however regenerating native shrub and ground layers are identifiable despite weed invasion.

Wherever possible, attempts have been made to avoid the planning of any development within areas containing STIF during the concept design phase in an effort to minimise impacts on the community. All retained vegetation on the subject site, will be managed in accordance with the approved Biodiversity Management Plan (BMP) to ensure that the quality of the vegetation is maintained and, where possible, improved through assisted rehabilitation and weed management. If necessary, further mitigation measures are to be determined in consultation of the relevant government bodies.

5.3.2 Mitigation of STIF affected by APZs

A Bushfire Management Plan has been approved for all bushfire protection issues of the subject land. The plan is sympathetic to the ecological significance of the STIF and aims to manage bushfire protection issues and the subject land's fuel loads in an ecologically sustainable manner.

5.3.3 Mitigation of Fragmentation

Fragmentation of the STIF will occur in small areas to the east of the subject site. A small access track will be cleared to enable access for construction of the eastern portion of the proposed development. The access track will be restricted to the area currently managed as APZ, which already has a cleared and fuel managed understory. Mitigation of this fragmentation will take place, through the maintenance of crown connectivity across this track where possible. This will allow the continued movement of birds and arboreal fauna within the patch.

5.3.4 Mitigation of Altered Hydrological Flows

Mitigation measures to prevent impacts of altered hydrological flows from the proposed development on the vegetation have been covered in the Flooding and Stormwater Management Plan (Hyder Consulting Pty Ltd, 2008). Such measures include detention basins, gross pollutant traps and rain water tanks designed to reduce the volume of stormwater entering the vegetation and remove pollutants and nutrients. The BMP prepared for the site will manage and monitor any changes in community composition that potentially could arise from an alteration in hydrological flows.

5.3.5 Mitigation of Altered Light Regimes

Altered light regimes have the potential to alter the community composition through the loss of light-dependent and light-sensitive species. The overshadowing of species from buildings and the increased light penetration from clearing for the proposed development has the potential to alter the community composition within the STIF. The BMP prepared for the site will manage and monitor any changes in community composition that potentially could arise from an alteration in light regimes. Following monitoring, plans of action will be prepared for situations where altered light regimes are suspected of impacting species composition,

5.4 Threatened Fauna Specific Mitigation

A number of TSC Act and EPBC Act listed fauna threatened species are known to use or have potential to use the subject site. A suspected nesting location of the TSC Act listed Powerful Owl (*Ninox strenua*) was also located within the subject land. These threatened species will potentially be impacted by the proposed development. The information below provides mitigation measures and management strategies designed to minimise these impacts.

5.4.1 Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox has been recorded on the subject land (Conacher Travers, 2004) which provides suitable foraging habitat for the species. Mitigation measures have been undertaken throughout the redevelopment of the Wahroonga Estate. These include the planting of appropriate feed trees, particularly winter flowering species, throughout the subject lands landscaping works. The Grey-Headed Flying-Fox suffers potential food shortages during the colder months with the reduction in flowering trees. Appropriate feed

trees that are to be used in landscaping works include *Corymbia gummifera* (Red Bloodwood), *Corymbia maculata* (Spotted Gum), *Eucalyptus paniculata* (Grey Ironbark), *Acacia longifolia* (Sydney Golden Wattle) and *Syzygium paniculatum* (Lilly-pilly). Further appropriate feed species are outlined in the BMP.

5.4.2 Nectivorous Birds

While not recorded on the subject site, Swift Parrots, Little Lorikeets and Regent Honeyeaters have been recorded within the wider locality in recent years. The proposed development will result in the loss of a minor area of potential foraging habitat. To mitigate against the impacts of lost foraging habitat, the planting of winter flowering feed trees for this species will be included in the landscaping of the Wahroonga Estate lands. Such species include *Corymbia gummifera* (Red Bloodwood), *Corymbia maculata* (Spotted Gum) and *Eucalyptus paniculata* (Grey Ironbark). Other species potentially included in landscaping works include those that suffer from lerp infestation such as *Eucalyptus pilularis* (Blackbutt). Other feed trees considered appropriate for this species that could be planted on the subject land are outlined in the site specific BMP.

5.4.3 Powerful Owl (*Ninox strenua*)

As stated previously, a pair of Powerful Owl adults and a recently fledged juvenile have been recorded roosting in the vegetation adjacent to the subject site during previous surveys. Appropriate mitigation measures to minimise these impacts have been implemented, including designing buildings at a minimum 100m setback from the potential roost tree.

5.4.4 Other Threatened Birds

The subject site provides potential foraging and roosting for the threatened birds Gang-gang Cockatoo (*Callocephalon fimbriatum)* and Glossy Black Cockatoo (*Calyptorhynchus lathami)*. Feed and roost tree species will be retained within the subject site and managed according to the approved BMP. Specifically, forage tree species for the Glossy Black Cockatoo such as *Allocasuarina spp.* will not be removed as part of the proposal.

5.4.5 Microchiropteran Bats

The subject site provides habitat for the TSC Act-listed vulnerable bat Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) and potential habitat for the threatened bats Eastern Bent-wing Bat (*Miniopterus oriane oceanensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Little Bent-wing Bat (*Miniopterus australis*) and Eastern Free-tail Bat (*Mormopterus norfolkensis*). Retention of tree hollows and sandstone overhangs across the subject land will ensure that appropriate roosting habitat for these species is retained within the subject land. Open areas of grassland suitable for foraging will be retained within the subject site.

Chapter 6

Conclusion

6.1 Conclusions

The proposed redevelopment of the subject site allows for the provision of office premises used for professional activities to build on the present working/living community. The subject site contains a number of complex ecological issues including; Sydney Turpentine-Ironbark Forest, an EEC listed under the TSC Act and a CEEC listed under the EPBC Act, a probable nesting location for Powerful Owls, and known foraging habitat for the Eastern False Pipistrelle and the Grey-headed Flying-fox. The site also provides suitable foraging habitat for a number of threatened species not recorded on the subject site such as microchiropteran bats and other birds. No threatened flora species have been detected on the subject site.

The proposed development will result in the removal of three trees diagnostic of STIF, with potential longer-term impacts to two other trees diagnostic of STIF. Additionally, it will remove a small area (0.05 ha) of potential foraging habitat for nectivorous bird and bat species. The proposal will not involve the clearing of feed tree species of the Glossy Black-cockatoo.

A range of mitigation measures are proposed to avoid both on and off-site impacts. These include erosion and sediment control to avoid stormwater and sediment runoff, the implementation of on-site water detention measures to minimise long term impacts downslope of the site, pre-clearance surveys to relocate any fauna present, signage to ensure that no unnecessary clearing occurs, and protection of trees to be retained through fencing.

No significant impact is predicted to occur to threatened species or C/EECs as a result of the development, and the preparation of a Species Impact Statement (SIS) is not warranted.

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Appendix A

Survey Results

Table 6.1 Flora Survey Results

Family	Common Name	Scientific Name	Transect 1	Transect 2
Trees				
Bignoniaceae	*Jacaranda mimosifolia**	Jacaranda	x	
Eleocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash	x	
Meliaceae	*Melia azedarach var. australasica*	White Cedar	x	
	Acacia parramattensis	Parramatta Wattle		x
Myrtaceae	*Angophora costata*	Smooth-barked Apple	x	
Myrtaceae	*Corymbia eximina*	Yellow Bloodwood		x
	Eucalyptus elata	River Peppermint		x
	Eucalyptus microcorys	Tallowwood		x
	Eucalyptus paniculata subsp. paniculata	Grey Ironbark	x (T245)	
	Eucalyptus pilularis	Blackbutt	x	
	Eucalyptus racemosa	Narrow-leaved Scribbly Gum		x (T101)
	Eucalyptus resinifera subsp. resinifera	Red Mahogany	x(T240)	
	Eucalyptus saligna	Sydney Blue Gum		x(T100)
	Syncarpia glomulifera	Turpentine	x	
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	x	
Small Trees				
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak	x	
Cupressaceae	*Cupressus sp 1*		x	

Table 6.1 Flora Survey Results

Family	Common Name	Scientific Name	Transect 1	Transect 2
Meliaceae	*Melia azedarach var. australasica*	White Cedar	x	
Proteaceae	*Stenocarpus sinuatus*	Firewheel tree	x	
Santalaceae	*Exocarpos cupressiformis*	Native Cherry	x	
Shrubs				
Araceae	*Monstera deliciosa**	Fruit-salad Plant		x
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax	x	
Altingiaceae	*liquidambar*			
Asteraceae	*Ozothamnus diosmifolius*	Ball Everlasting	x	
Cesalpinioideae	*Senna pendula var. glabrata**	-	x	
Melastomataceae	*Tibouchina sp.*	Tibouchina		x
Myrtaceae	*Angophora costata*	Smooth-barked Apple		x
	Callistemon salignus	Willow Bottlebrush	x	
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant	x	
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet		x
	*Ligustrum sinense**	Small-leaved Privet	x	
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum		x
Proteaceae	*Grevillea robusta*	Silky oak	x	
Rubiaceae	*Gardenia sp.**	Gardenia		x
Solanaceae	*Solanum mauritianum**	Wild Tobacco		x

Table 6.1 Flora Survey Results

Family	Common Name	Scientific Name	Transect 1	Transect 2
Verbenaceae	*Lantana camara**	Lantana	x	
Groundcovers				
Asparagaceae	*Asparagus densiflorus**	Asparagus Fern	x	
	*Chlorophytum comosum**	Spider Plant		x
	*Protasparagus plumosus**	Climbing Asparagus Fern	x	
Asteraceae	*Ageratina adenophorum**	Crofton Weed	x	
	*Cirsium vulgare**	Spear Thistle		x
	*Conyza albida**	Fleabane	x	
	*Conyza bonariensis**	Fleabane		x
	Gnaphalium americanum			x
	*Hypochaeris radicata**	Flatweed		x
Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell		x
	*Tradescantia fluminensis**	Wandering Jew	x	
Convolvulaceae	*Dichondra repens*	Kidney Weed	x	x
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge	x	
Geraniaceae	*Geranium homeanum*	Northern Cranesbill	x	
Iridaceae	*Dietes grandiflora*	Fairy Iris	x	
Liliaceae	*Agapanthus praecox**	Agapanthus		x
Lobeliaceae	*Pratia purpurascens*	Whiteroot	x	

Table 6.1 Flora Survey Results

Family	Common Name	Scientific Name	Transect 1	Transect 2
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne	x	
	Modiola caroliniana			x
Oxalidaceae	*Oxalis sp.*			x
Phormiaceae	*Dianella caerulea var. assera*	Flax Lily		x
Phormiaceae	*Dianella prunina*	-		x
Plantaginaceae	*Plantago lanceolata**	Ribwort	x	
Poaceae	*Axonopus affinis**	Narrow-leafed Carpet Grass	x	
	*Bromus cartharticus**	Prairie Grass	x	
	Cynodon dactylon	Common Couch		x
	Dichelachne micrantha	Short-hair Plume Grass	x	
	*Ehrharta erecta**	Panic Veldtgrass		x
	Ehrharta erecta	Panic Veldtgrass	x	
	Microlaena stipoides var. stipoides	Weeping Rice Grass	x	x
	Oplismenus aemulus	Basket Grass	x	
	*Paspalum dilatatum**	Paspalum		x
	*Pennisetum clandestinum**	Kikuyu	x	
	*Stenotaphrum secundatum**	St. Augustine Grass		x
Primulaceae	*Anagallis arvensis**	Scarlet Pimpernel	x	
Strelitzeaceae	*Strelitzea juncea**	Bird of Paradise		x

Table 6.1 Flora Survey Results

Family	Common Name	Scientific Name	Transect 1	Transect 2
Verbenaceae	*Duranta sp.*			x
	Verbena officinalis	Common verbena	x	
Herbs- Ferns and Allies				
Davalliaceae	*Nephrolepis cordifolia*	Fishbone Fern	x	
Climbers				
Asclepiadaceae	*Araujia hortorum**	Mothvine	x	
Fabaceae	*Glycine tabacina*	Twining Glycine	x	
Nyctaginaceae	*Bougainvillea glabra*		x	
Passifloraceae	*Passiflora edulis**	Common Passionfruit	x	

Table 6.2 Fauna Survey Results

Scientific Name	Common Name	Current Survey	Previous surveys
Birds			
Psophodes olivaceus	Eastern Whipbird	H	
Vanellus Miles	Masked Lapwing		X
Streptopelia chinensis	Spotted Turtle-Dove		X
Ocyphaps lophotes	Crested Pigeon		X

Table 6.2 Fauna Survey Results

Scientific Name	Common Name	Current Survey	Previous surveys
Cacatua galerita	Sulphur-crested Cockatoo	O	X
Cacatua tenuirostris	Long-billed Corella		X
Cacatua roseicapilla	Galah		X
Trichoglossus haematodus	Rainbow Lorikeet	O	X
Afsterus scapularis	Australian King-Parrot		X
Platycerous elegans	Crimson Rosella		X
Platycercus eximius	Eastern Rosella		X
Ninox strenua	Powerful Owl [TS]		O
Podargus strigoides	Tawny Frogmouth		X
Ninox novaeseelandiae	Southern Boobook		X
Eudynamys scolopacea	Common Koel		X
Eurystomus orientalis	Dollarbird		X
Dacelo novaeguineae	Laughing Kookaburra		X
Cormobates leucophaeus	White-throated Treecreeper		X
Oriolus sagittatus	Olive-backed Oriole		X
Manorina melanocephala	Noisy Miner	O	X
Anthochaera carunculata	Red Wattlebird		X
Anthochaera chrysoptera	Little Wattlebird		X
Meliphaga lewinii	Lewin's Honeyeater		X

Table 6.2 Fauna Survey Results

Scientific Name	Common Name	Current Survey	Previous surveys
Lichenostomus leucotis	White-eared Honeyeater		X
Myzomela sanguinolenta	Scarlet Honeyeater		X
Acanthorhynchus tenuirostris	Eastern Spinebill		X
Acanthiza pusilla	Brown Thornbill		X
Acanthiza reguloides	Buff-rumped Thornbill		X
Pardalotus punctatus	Spotted Pardalote		X
Eopsaltria australis	Eastern Yellow Robin		X
Rhipidura fuliginosa	Grey Fantail		X
Coracina novaehollandiae	Black-faced Cuckoo-shrike		X
Sericornis frontalis	White-browed Scrubwren		X
Hirundo neoxena	Welcome Swallow		X
Cracticus torquatus	Grey Butcherbird	O	
Strepera graculina	Pied Currawong		X
Dicrurus bracteatus	Spangled Drongo		X
Gymnorhina tibicen	Australian Magpie	O	
Corvus coronoides	Australian Raven		X
Ptilonorhynchus violaceus	Satin Bowerbird		X
Neochmia temporalis	Red-browed Finch		X
Malurus cyaneus	Superb Fairy-wren		X

Table 6.2 Fauna Survey Results

Scientific Name	Common Name	Current Survey	Previous surveys
Acridotheres tristis	Common Myna *		X
Sturnus vulgaris	Common Starling *		X
Pycnonotus jocosus	Red-whiskered Bulbul *		X
Amphibians			
Litoria phylochroa	Leaf Green Tree Frog		O
Limnodynastes peronii	Striped Marsh Frog		O
Crinia signifera	Common Froglet		O
Reptiles			
Physignathus lesueurii	Eastern Water Dragon		X
Tiliqua nigrolutea	Blue Tongue Lizard		X
Pseudechis porphyriacus	Red-Bellied Black Snake		X
Lampropholis guichenoti	Garden Skink		X
Eulampris quoyii	Eastern Water Skink	O	
Mammals			
Oryctolagus cunniculus	Rabbit	O	
Rattus novergicus	Brown Rat*		X
Rattus rattus	Black Rat*		Hairtube
Trichosurus vulpecula	Common Brushtail Possum		Hairtube
Pseudocheirus peregrinus	Common Ring-tail Possum		O

Table 6.2 Fauna Survey Results

Scientific Name	Common Name	Current Survey	Previous surveys
Vulpes vulpes	European Red Fox*		Scat
Paramelidae	Bandicoot Sp		Scat
Felis Cattus	Cat		X
Chalinolobus gouldii	Gould's Wattled Bat		Anabat
Falsistrellus tasmaniensis	Eastern False Pipistrelle TS		Anabat
Pteropus poliocephalus	Grey-Headed Flying-fox TS		O

*Notes: *= Exotic Species, TS= Threatened Species, O=Observed Visually, H= Observed Aurally, X= Recorded on site, Anabat= Detected with Anabat, Hairtube=Detected using Hairtube Sampling*

Appendix B

Likelihood of Occurrence

Table 6.3 Flora Likelihood of Occurrence Table

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
	Marsdenia viridiflora subsp. viridiflora	Marsdenia viridiflora subsp. Viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs	E		10	Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range. Grows in vine thickets and open shale woodland	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted flora survey
	Dillwynia tenuifolia		V	V	9	It has a core distribution within the Cumberland Plain, where it may be locally abundant within scrubby, dry heath areas within Castlereagh Ironbark Forest and Shale/Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in the ecotone between these areas and Castlereagh Scribbly Gum Woodland. Flowers sporadically from August to March.	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted flora survey
	Pultenaea parviflora		E	V	6	May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in ecotone between these communities and Castlereagh Scribbly Gum Woodland.	Low likelihood of occurrence. No suitable habitat within the study area. Not

Table 6.3 Flora Likelihood of Occurrence Table

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
						Eucalyptus fibrosa is usually the dominant canopy species. E. globoidea, E. longifolia, E. parramattensis, E. sclerophylla and E. sideroxylon may also be present or co-dominant, with Melaleuca decora frequently forming a secondary canopy layer. Associated species may include Allocasuarina littoralis, Angophora bakeri, Aristida spp. Banksia spinulosa, Cryptandra spp., Daviesia ulicifolia, Entolasia stricta, Hakea sericea, Lissanthe strigosa, M. nodosa, Ozothamnus diosmifolius and Themeda australis . Often found in association with other threatened species such as Dillwynia tenuifolia, Dodonaea falcata, Grevillea juniperina, Micromyrtus minutiflora, Persoonia nutans and Styphelia laeta. Flowering may occur between August and November.	recorded during targeted flora survey
							Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted flora survey
	Acacia pubescens	Downy Wattle	V	V	12	Associated with on Cumberland Plain Woodlands, Shale/Gravel Forest and Shale/ Sandstone Transition Forest. Clay soils, often with ironstone gravel.	
	Grevillea juniperina	Juniper-leaved	V		79	Restricted to red sandy to clay soils – often lateritic on	Low likelihood of

Table 6.3 Flora Likelihood of Occurrence Table

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
	subsp. juniperina	Grevillea				Wianamatta Shale and Tertiary alluvium in Cumberland Plain Woodland and Castlereagh Woodland	occurrence. No suitable habitat within the study area. Not recorded during targeted flora survey
	Grevillea parviflora subsp. parviflora	Small-flower Grevillea		V		Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest.	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted flora survey
	Pimelea spicata	Spiked Rice-flower	E	E	18	In western Sydney, it occurs on an undulating topography of well structured clay soils, derived from Wianamatta shale. It is associated with Cumberland Plain Woodland (CPW), in open woodland and grassland often in moist depressions or near creek lines. Has been located in disturbed areas that would have previously supported CPW	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted flora

Table 6.3 Flora Likelihood of Occurrence Table

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
							survey
	Pimelea curviflora var. curviflora		V	V		Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted flora survey
	Cynanchum elegans	White-flowered Wax Plant	E	E		The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree Leptospermum laevigatum – Coastal Banksia Banksia integrifolia subsp. integrifolia coastal scrub; Forest Red Gum Eucalyptus tereticornis aligned open forest and woodland; Spotted Gum Corymbia maculata aligned open forest and woodland; and Bracelet Honeymyrtle Melaleuca armillaris scrub to open scrub.	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted flora survey
	Persoonia nutans	Nodding Geebung	E1	E		Confined to aeolian and alluvial sediments and occurs in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum	Low likelihood of occurrence. No suitable habitat within the study

Table 6.3 Flora Likelihood of Occurrence Table

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
						Woodland.	area. Not recorded during targeted flora survey
	Pomaderris brunnea	Rufous Pomaderris	V	V		Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted flora survey
	Pterostylis gibbosa	Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood		E		Found in open forest or woodland, on flat or gently sloping land with poor drainage.	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted flora survey
	Pterostylis saxicola	Sydney Plains Greenhood		E		Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff	Low likelihood of occurrence. No

Table 6.3 Flora Likelihood of Occurrence Table

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
						lines. The vegetation communities above the shelves where Pterostylis saxicola occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	suitable habitat within the study area. Not recorded during targeted flora survey
	Streblus pendulinus	Siah's Backbone, Sia's Backbone, Isaac Wood		E		On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest.	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted flora survey

(Unlikely, Possible, Probable, Confirmed)

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
Gastropoda							
	Meridolum corneovirens	Cumberland Plain Land Snail	E1		69	Lives in a restricted area in the Cumberland Plain west of Sydney under litter of leaves, bark and logs or in loose soil around grass clumps feeding on fungus. Primarily inhabits Cumberland Plain Woodland.	Limited suitable habitat. Species is unlikely to occur within subject site.
Amphibians							
	Litoria aurea	Green and Golden Bell Frog	E1	V	2	Marshes, dams, stream sides, particularly those containing bullrushes or spikerushes; unshaded water bodies free of Gambusia form optimum habitat; vegetation and/or rocks are needed for sheltering.	Low likelihood of occurrence. This species has not been recorded in the locality for many decades. Suitable habitat present on the subject site but

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
							not recorded during targeted fauna survey.
	Litoria raniformis	Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog		V		Found in or around permanent or ephemeral swamps or billabongs along floodplains and river valleys	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted fauna survey
	Helioporus autraliacus	Giant Burrowing Frog		V		Found in heath, woodland and open forest with sandy soils.	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted fauna survey

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
	Mixophyes iteratus	Giant Barred Frog, Southern Barred Frog		E		Inhabit deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m.	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted fauna survey
Reptilia							
	Hoplocephalus bungaroides			V		Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges or in hollows in large trees within 200 m of escarpments	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted fauna survey
Varanidae	*Varanus*	Broad-headed Snake Rosenberg's	V,P		8	Found in heath, open forest and woodland. Associated with termites, the mounds of which this	Low, no suitable habitat

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
	rosenbergi	Goanna				species nests in; termite mounds are a critical habitat component.•Individuals require large areas of habitat. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens.	or records in proximity to the site
Birds							
	Anthochaera phrygia	Regent Honeyeater	E4A	CE, M		Inhabits temperate woodlands and open forests, particularly Box-Ironbark Woodland and riparian forests of She-oak, with significantly large numbers of mature trees, high canopy cover and abundance of mistletoe. Feeds mainly on nectar and fruit from eucalypts and mistletoes and occasionally on insects. Requires shrubby understorey for nesting material. Nomadic movement of the species may depend on flowering and other resource patterns.	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
	Lathamus discolor	Swift Parrot	E1	E	3	Migrates between Tasmania and the mainland. Occurs where there are abundant eucalypt flowers or lerp infestations. Favours winter flowering eucalypt species including Swamp Mahogany, Spotted Gum, Red	Limited suitable habitat within the subject site. Not likely to occur.

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
						Bloodwood, Mugga Ironbark and White Box	
	Daphoenositta chrysoptera	Varied Sittella	V		3	The Varied Sittella is sedentary and inhabits most of mainland Australia. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Low.Limited .potential habitat exists for the species on the site
	Petroica phoenicea	Flame Robin	V		1	Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes.	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted fauna survey
	Lophoictinia isura	Square-tailed Kite	V		1	Diverse habitats from woodlands to timbered watercourses	Low. Little potential habitat exists for the species on the site

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
	Tyto novaehollandiae	Masked Owl	V		1	Occurs in forests, open woodlands, farmlands with large trees. Roosts in large hollow	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
	Ninox strenua	Powerful Owl	V		64	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	Moderate, some suitable forage habitat on the subject site. Species detected adjacent to subject site.
	Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V		1	Drier eucalypt forests, woodlands, timber on water courses, often no understorey, scrubs. Favours ironbark woodlands on western slopes.	Low likelihood of occurrence. Limited suitable habitat within the

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
							study area. Not recorded during targeted fauna survey
	Hieraaetus morphnoides	Little Eagle	V			Inhabits open eucalypt forest, woodlands or open woodland.	Low. Little potential habitat exists for the species on the site
					8		
	Botaurus poiciloptilus			E		Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (Typha spp.) and spikerushes (Eleoacharis spp.).	Low. Limited potential habitat exists for the species on the site, no records in the locality
		Australasian Bittern					
	Dasyornis brachypterus			E		Inhabits dense, fire prone, low vegetation areas like heathy woodland, open woodland with heath understory or open forest with tussock grass understory	Low likelihood of occurrence. No suitable habitat within the study
		Eastern Bristlebird					

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Commonwealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
							area. Not recorded during targeted fauna survey
	Erythrotriorchis radiatus	Red Goshawk	CE	V		Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers.	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
	Rostratula australis	Australian Painted Snipe		V, M		Found in covered grassy, low scrub or open timber areas on fringes of swamps, dams and marshes.	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
							survey
	Haliaeetus leucogaster	White-bellied Sea-Eagle		M,C		Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas. Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers.	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
	Hirundapus caudacutus	White-throated Needletail		M,C,J,K		Forages aerially over a variety of habitats usually over coastal and mountain areas with a preference for wooded areas	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
	Merops ornatus	Rainbow Bee-eater		M,J		Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks,	Low likelihood of occurrence.

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
						sand-pits, occasionally coastal cliffs .	Limited suitable habitat within the study area. Not recorded during targeted fauna survey
	Monarcha melanopsis					Rainforest and eucalypt forests,	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
		Black-faced Monarch		M			
	Myiagra cyanoleuca					Wetter, denser forest, often at high elevations	Low likelihood of occurrence. Limited suitable habitat within the study area. Not
		Satin Flycatcher		M			

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
							recorded during targeted fauna survey
	Rhipidura rufifrons					Found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
		Rufous Fantail		M			
	Ardea alba					Reported in a wide range of wetland habitats including river margins, lakes, salt marshes, estuarine mudflats, tidal streams and mangrove swamps	Moderate. Some potential habitat exists for the species on the site
		Great Egret, White Egret		M,C,J			
	Ardea ibis					Tend to forage in pasture, marsh, grassy road verges, rain puddles and croplands	Moderate. Some potential habitat exists for the
		Cattle Egret		M,C,J			

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
							species on the site
	Gallinago hardwickii					Inhabits a variety of permanent and ephemeral wetlands, preferring wetlands with nearby cover, including wetland grasses and open wooded swamps	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
		Latham's Snipe, Japanese Snipe		M,C,J,K			
	Apus pacificus					Common migrant throughout mainland Australia	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
		Fork-tailed Swift		M,C,J,K			
Fish							

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Commonwealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
	Macquaria australasica	Macquarie Perch		E		Prefers clear water and deep, rocky holes with lots of cover comprised of aquatic plants, large boulders, debris and overhanging banks.	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted fauna survey
	Prototroctes maraena	Australian Grayling		V		Inhabits clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops but has also been present in a muddy-bottomed, heavily silted habitat	Low likelihood of occurrence. No suitable habitat within the study area. Not recorded during targeted fauna survey
Mammals	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	14	Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Forage on nectar and pollen of native trees, especially	Moderate. Known roosting colony at Gordon, some

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
						Eucalyptus, Melaleuca and Banksia. Migrates in search of food.	suitable foraging resource on the subject site.
	Chalinolobus dwyeri	Large-eared Pied Bat, Large Pied Bat		V			Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
	Mormopterus norfolkensis	Eastern Freetail Bat	V			Occur in dry sclerophyll forest and woodland east of the Great Dividing Range	Moderate. Some habitat within the subject site. Recorded in adjacent sites in 2007. Likely to use site for foraging.

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Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
	Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		2	Occurs in moist habitat with trees over 20m in height, hunting insects above or just below the tree canopy. Roosts in eucalypt hollows, under bark and in buildings. Hibernates in winter.	Moderate. Some habitat within the subject site. Moderate likelihood of occurrence.
	Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		21	Roosts mainly in caves but also in tunnels, mines or buildings. Non-breeding populations disperse within a 300 km range of maternity caves. Hunting for moths and other insects takes place in forested areas above the canopy.	Moderate. Some habitat within the subject site. Recorded in adjacent sites in 2007. Likely to use site for foraging.
	Myotis macropus	Southern Myotis	V		5	Found along the coast and roost in caves, mine shafts, tree hollows or dense foliage. Foraging for fish and insects occurs over streams and pools.	Low likelihood of occurrence No suitable habitat within the subject site. .

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
	Scoteanax ruepellii	Greater Broad-nosed Bat	V		3	Usually roosts in tree hollows and forages for beetles and other insects or microbats along creek and river corridors in open woodland habitat and dry open forests	Moderate likelihood of occurrence Some habitat within the subject site. .
	Dasyurus maculatus	Spotted-tailed Quoll	V	E	6	Occurs in wide variety of habitats in large remnants. Dens in tree hollows, hollow logs or rock crevices	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
	Petrogale penicillata	Brush-tailed Rock-wallaby	E	V		Inhabits outcrops and cliffs with complex structures	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Commonwealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
							targeted fauna survey
	Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)	Koala	V	V		Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
	Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)	V	V		Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	Low likelihood of occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey
	Pseudomys	New Holland Mouse		V		The New Holland Mouse has been found from coastal areas	Low likelihood of

Table 6.4 Fauna Likelihood of Occurrence

Family	Scientific Name	Common Name	NSW Legal Status (TSC Act)	Common wealth Legal Status (EPBC Act)	OEH Bionet Records in Locality (5km radius)	Habitat Requirements	Likelihood of occurrence
	novaehollandiae					and up to 100 km inland on sandstone country. The species occurs in open heathland, open woodland with a heathland understorey and vegetated sand dunes.	occurrence. Limited suitable habitat within the study area. Not recorded during targeted fauna survey

Appendix C

Assessments of Significance

C.1 Endangered Ecological Communities

Sydney Turpentine-Ironbark Forest (STIF) typically occurs on the shale/sandstone boundary on the more fertile shale influenced soils, in higher rainfall areas on the higher altitude margins of the Cumberland Plain, and on the shale ridge caps of sandstone plateaus (OEH 2012). Dominant canopy trees include Turpentine (*Syncarpia glomulifera*), Grey Gum (*Eucalyptus punctata*), Grey Ironbark (*Eucalyptus paniculata*) and Thin-leaved Stringybark (*Eucalyptus eugenoides*). In areas of high rainfall (over 1050 mm per annum) Sydney Blue Gum (*Eucalyptus saligna*) is more dominant. The shrub stratum is usually sparse and may contain mesic species such as Sweet Pittosporum (*Pittosporum undulatum*) and Elderberry Panax (*Polyscias sambucifolia*).

STIF has a highly restricted geographic distribution, and is currently estimated to cover an extant area of just over 200 ha (Tozer, 2003). Less than 5% of the original forest is intact and retains the structural integrity of the vegetation. Existing remnants continue to be threatened by clearing and weed invasion. STIF is listed as an Endangered Ecological Community (EEC) under the TSC Act (as *Sydney Turpentine-Ironbark Forest*) and a Critically Endangered Ecological Community (CEEC) under the EPBC Act (as *Turpentine-Ironbark Forest in the Sydney Basin Bioregion*).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable to endangered communities.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable to endangered communities.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

The STIF vegetation on the subject site consists of diagnostic canopy species, predominantly *Syncarpia glomulifera* (Turpentine). Additional diagnostic species within the subject site include *Eucalyptus pilularis* (Blackbutt) and *Pittosporum undulatum* (Native Daphne) Three of these trees will be removed as a part of the proposed development, with a further two potentially impacted in the future. The trees occur on the degraded boundary of

a much larger patch of the vegetation community, thus its local occurrence is not likely to be places at risk of extinction.

The trees to be removed exists on the boundary of the community, with a modified ground story. It is considered unlikely that the removal of three trees diagnostic of the community will have an adverse affect on or substantially and adversely modify the composition or extent of the local occurrence of the STIF EEC.

(d) in relation to the habitat of a threatened species, population or ecological community:

> *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
>
> *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
>
> *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality, and*

The proposed action will result in the removal of three trees diagnostic of the EEC, with a potential longer-term impact on two others. Soils and habitat for the community within the subject site have been subjected to pressures of development such as increased nutrient loading from urban runoff, earthworks for adjacent development and altered fire regimes. As such, habitat for the community occurs in a degraded and fragmented state. The proposal is not likely to exacerbate these pre-existing impacts.

The habitat for the community will not become fragmented or isolated as a result of the proposed action. The vegetation patch will maintain connectivity in a north-south direction, including canopy connectivity. Genetic flow will continue throughout the patch of vegetation.

The habitat is not considered to be important to the long-term survival of the vegetation community in the locality. Areas of the community are reserved in conservation areas adjacent to the subject site, and community within private property adjacent to the site is managed in accordance with an approved Biodiversity Management Plan, which will ensure the survival of the community in the long term. The removal of habitat for this community is not considered to generate an impact on its long term survival.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for the STIF EEC has been identified by the Director-General of OEH under the TSC Act. The subject site does not constitute critical habitat for this EEC.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan or threat abatement plan has been prepared for STIF EEC. The main objective of recovery planning for EECs is to avoid further loss of these communities and to facilitate their recovery. The proposal is considered to be consistent with these objectives as no remnant canopy tree species are to be removed as part of the proposed action.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The action constitutes the key threatening process of **Clearing of Native Vegetation**.

Conclusion

Though the clearing of three individuals of STIF EEC diagnostic canopy species will occur as part of the proposed development, the clearing is not considered to constitute a significant impact. Further, the longer-term decline of two additional trees is not considered likely to constitute a significant impact. A Biodiversity Management Plan will manage retained vegetation, including patches of STIF adjacent to the subject site, in the long term. The proposed action will not isolate or fragment habitat for the community, nor will it disturb habitat for the community. No significant impact to the STIF EEC is likely to occur as a result of the proposed development.

C.2 Threatened Fauna Species

C.2.1 Nectivorous Birds

This test assesses the Regent Honeyeater, Little Lorikeet and Swift Parrot together as the species have similar habitat requirements and are affected by the same potential threats as a result of the proposal. These species have not been detected on the subject site or lands, but are considered to have potential to forage in the area during migrations.

The Little Lorikeet (*Glossopsitta pusilla*) is listed as vulnerable under the TSC Act and has the potential to forage within the subject land opportunistically during locally prolific blossom periods or when other nectar sources are scarce. The Little Lorikeet mostly occurs in dry, open eucalypt forests and woodlands and is distributed in NSW from the coast to the western slopes of the Great Dividing Range (Barrett et al. 2003). The species is considered to be nomadic (Higgins 1999), with irregular large or small influxes of individuals occurring at any time of year, apparently related to food availability where there is some tree-flowering in the vicinity (DECCW (NSW) 2010). The species uses patches of vegetation as 'stepping stones' to travel across landscapes. While not previously recorded on the subject land the species has been previously recorded within Lane Cove National Park (OEH, 2012).

The Swift Parrot, listed as Endangered under both the TSC Act and EPBC Act, is a predominantly nectarivorous, migratory species endemic to southeastern Australia (Birds Australia 2011). The species breeds in Tasmania and migrates to the mainland in winter, where it is most commonly found in dry, open eucalypt forests and woodlands containing Grey Box, White Box and Yellow Gum (Garnett and Crowley 2000). The species is reliant on box-ironbark communities for winter foraging, and movement is strongly associated with the

availability of lerps and winter flowering eucalypt species such as Eucalyptus sideroxylon (Mugga Ironbark). Swift Parrots often occur in urban areas, including farmland with remnant patches of eucalypt woodland (DEC (NSW) 2005f), (Saunders and Heinsohn 2008). The species has been recorded in close proximity to the subject site, and also in Lane Cove and Garigal National Parks (OEH, 2012)

The Regent Honeyeater (*Anthochaera phrygia*), listed as Critically Endangered under the TSC Act and Endangered under the EPBC Act, is a winter migrant confined to Victoria and NSW and is strongly associated with the western slopes of the Great Dividing Range (Garnett and Crowley 2000). The species is found in temperate eucalypt forests and woodlands, particularly in blossoming trees and mistletoe (DEC (NSW) 2006b). The Regent Honeyeater is strongly nomadic and follows blossoming trees (Franklin et al. 1989) (NSW Scientific Committee 2004f). The species uses patches of vegetation as 'stepping stones' to travel across landscapes. The species has not been recorded within the subject site, nor within five kilometres of the subject site; however it is considered to have potential to occur as suitable winter-flowering trees are available.

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

None of the previously listed nectivorous bird species have been recorded from the subject site; however they have been recorded in the locality. A very small area (0.05 ha) of potential foraging and roosting habitat is available on the subject site. Given the large home ranges of these species and the presence of more suitable habitat in the locality, it is unlikely that the viability of any local populations will be adversely affected by the proposed development.

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

There are currently no populations of these species listed as endangered under the TSC Act.

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

A small area (0.05 ha) of potential foraging habitat for the Regent Honeyeater, Little Lorikeet and Swift Parrot will be removed. This represents a small portion of the available habitat within the subject land and wider locality.

Vegetation on the subject site will continue to be connected to adjacent stands of vegetation. The proposed development will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat. All species are highly mobile and are capable of flying over developed areas in the locality. Based on this, the impacts of the project are not expected to have a deleterious impact upon habitat corridors or habitat connectivity for dispersal of the species.

(e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

No critical habitat for the Regent Honeyeater, Little Lorikeet and Swift Parrot has been identified by the Director-General of OEH under the TSC Act..

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

Recovery plans have been prepared for the Swift Parrot and the Regent Honeyeater. The general aims of these plans include the protection and enhancement of key breeding and foraging habitats for these species. The subject site does not occur in any key breeding or foraging areas for these species and is therefore consistent with these plans.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The following Key Threatening Processes are relevant to the Swift Parrot, Little Lorikeet and Regent Honeyeater:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;

- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
- **Competition and grazing by the feral European rabbit *Oryctolagus cuniculus*** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation by the European Red Fox *Vulpes vulpes*** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*** as wallowing and rooting causes direct disturbance to habitats and may increase erosion; and
- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources.

The Key Threatening process of Clearing of Native Vegetation is relevant to this project, as it will result in the removal of a small number of native trees. The remainder are relevant to the project and it will not result in the operation of these processes.

Conclusion

A small area of potential foraging habitat (0.05 ha) for the Regent Honeyeater, Little Lorikeet and Swift Parrot will be removed from the subject site. Any local population of these species is predicted to remain viable within the locality. No significant impact is predicted to occur to the Regent Honeyeater, Little Lorikeet and Swift Parrot as a result of the proposed development.

C.2.2 Glossy Black Cockatoo (Calyptorhynchus lathami)

The Glossy Black Cockatoo is listed as Vulnerable under TSC Act. The species is sparsely distributed along the east coast and immediate inland districts from western Victoria to Rockhampton in Queensland (Crome and Shields 1992). The Glossy Black Cockatoo characteristically inhabits forests on sites with low soil-nutrient status, reflecting the distribution of key *Allocasuarina* spp, predominantly Forest Oak (*Allocasuarina torulosa*) and Black She-oak (*Allocasuarina littoralis*) in eastern populations (NSW NPWS 1999).

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Glossy Black-cockatoo is not known to occur on the subject site. Suitable foraging habitat exists for this species on the subject site, however suitable nesting habitat is absent. Glossy Black-cockatoo require large hollows to nest and individual pairs show high fidelity to selected nesting trees (choosing nesting hollows of particular shape, position and structure)(DEC (NSW) 2005c). Hollows on the subject site are not large enough for utilisation by Glossy Black-cockatoo. As nesting habitat is absent from the subject site, it is not likely that the proposal will affect the life cycle of these species such that a viable local population is placed at risk of extinction.

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

Not applicable

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

No foraging habitat for the Glossy Black-cockatoo will be removed.

Vegetation on the subject site will continue to be connected to adjacent stands of vegetation. The proposed development will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat. The Glossy Black-cockatoo is a highly mobile species and is capable of flying over developed areas in the locality. Therefore no area of habitat will be fragmented or isolated from other areas of habitat by the proposed development.

The subject site affords a very small area of foraging habitat for the Glossy Black-cockatoo. As this species is highly mobile and moves around according to the availability of foraging habitat, it is likely to use a much broader area of habitat, including large areas of, Lane Cove, Garigal and Ku-ring-gai National Parks. Therefore the land affected by the proposal is not important habitat for this species. Furthermore, no nesting habitat for this species will be removed. The removal and modification of the vegetation on the subject site is not likely to have an adverse effect on the long-term survival of this species.

(e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of OEH.

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

No recovery plan for this species has been prepared by the NSW National Parks and Wildlife Service to date. OEH has recommended

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The following Key Threatening processes are relevant to the Glossy Black-cockatoo:

- **Clearing of native vegetation** as this destroys habitat for the species.
- **Competition from feral honeybees** as feral honeybees compete with native species for tree hollows;
- **Infection of native plants by *Phytophthora cinnamomi*** as vegetation that is utilised by this species may be susceptible and may be killed or damaged;
- **Infection by Psittacine circoviral (beak and feather) disease** affecting endangered psittacine species and populations as it can leave Glossy Black-cockatoo prone to other infections; and
- **Predation by the European red fox** as fledglings can become prey items for foxes.

The proposed development would result in the clearing of native vegetation which provides potential foraging habitat for the Glossy Black-cockatoo.

The proposed development will not increase competition from feral honeybees for hollows as no hollows of suitable size for nesting are proposed to be removed.

There are no signs that *Phytophthora cinnamomi* is currently impacting vegetation on the subject site and it is not likely that the process will be exacerbated as a result of the proposal.

The proposed development will not exacerbate the likelihood of Psittacine circoviral (beak and feather) disease infecting a local population.

Foxes are not likely to exist on the subject site and are not likely to be increased in number by the proposal.

Conclusion

No foraging habitat for the Glossy Black-cockatoo will be removed from the subject site. The local population of the Glossy Black-cockatoos is predicted to remain viable within the locality. No significant impact is predicted to occur to the Glossy Black-cockatoo as a result of the proposed development.

C.2.3 Forest Owls

The Barking Owl (*Ninox connivens*) is widespread and quite common in parts of northern Australia but is considered generally uncommon in southern Australia. The owl is distributed sparsely throughout NSW although it is rarely recorded in the far west or in coastal or escarpment forests. It occurs in eucalypt woodland, open forest, swamp woodlands and timber along watercourses. It roosts in dense foliage of understorey trees during the day and nest in hollows of old eucalypts(DEC (NSW) 2005a). The Barking Owl is listed as Vulnerable on Schedule 2 of the TSC Act(NSW Scientific Committee 2004a).

The Powerful Owl (*Ninox strenua*) is distributed from Mackay to south western Victoria, mainly on the coastal side of the Great Dividing Range. This species occurs in many vegetation types from woodland and open sclerophyll to tall open wet forest and rainforest. It requires large tracts of native vegetation but can survive in fragmented landscapes. It roosts in dense vegetation and nests in large tree hollows(DEC (NSW) 2005d). The Powerful Owl is listed as Vulnerable on Schedule 2 of the TSC Act(NSW Scientific Committee 2004e).

(h) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

Neither the Powerful Owl nor the Barking Owl has been recorded from the subject site; however they have been recorded in the locality. The Powerful Owl has been observed on the subject land. Potential foraging habitat is available on the subject site, however nesting habitat is absent due to a lack of large hollows. Given the large home ranges of these species, the absence of suitable sized nesting hollows on the subject site, the presence of more suitable habitat in the locality and its ability to adapt to disturbance within its home range it is unlikely that the viability of the local population will be adversely affected by the proposed development.

(i) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

There are currently no populations of the Powerful or Barking Owl listed as endangered under the TSC Act.

(j) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(k) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

A small area of potential foraging habitat (0.05ha) for the Barking Owl and Powerful Owl will be removed. This represents a small portion of the available habitat within the study area and wider locality. Known roosting habitat for the Powerful Owl will be retained.

Vegetation on the subject site will continue to be connected to adjacent stands of vegetation. The proposed development will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat. Both species are highly mobile and are capable of flying over developed areas in the locality. Based on this, the impacts of the project are not expected to have a deleterious impact upon habitat corridors or habitat connectivity for dispersal of the species.

The subject site affords foraging and roosting habitat for the Barking Owl. As this species is highly mobile and moves around according to the availability of foraging habitat, it is likely to use a much broader area of habitat, including large areas of Lane Cove National Park and Ku-ring-gai National Park. Therefore the land affected by the proposal is not important

habitat for this species. The removal and modification of the vegetation on the subject site is not likely to have an adverse effect on the long-term survival of this species.

(l) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

No critical habitat for these species has currently been listed in the critical habitat registry by the Director-General of OEH.

(m) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

A draft recovery plan has been prepared for the Barking Owl. The ultimate aim of the recovery plan is to recover the Barking Owl to a position of viability in nature in NSW (NSW NPWS 2003).

The subject site is not part of a known area of habitat for the Barking Owl. Potential roosting habitat will be retained in the locality.

DECCW has identified 17 priority actions to assist with the recovery of this species in New South Wales. These include:

- Negotiate with individual land managers to achieve appropriate measures to protect all known Barking Owl nest sites in NSW. Protection will need to address threats such as human disturbance, collision with wires, secondary poisoning from chemicals;
- Incorporate the consideration of Barking Owl habitat and potential habitat as a high priority in the assessment of property for reserve establishment;
- Establish formal conservation arrangements for properties with Barking Owls, which can be used to protect wildlife habitat.

Additionally, a recovery plan has been prepared for large forest owls, which includes the Powerful Owl. The aim of the recovery plan is to ensure that large forest owls persist in the wild in NSW in each region where they presently occur (DEC (NSW) 2006a). The following main objectives are relevant to the proposal:

- Objective 4: Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes; and
- Objective 5: Minimise further loss and fragmentation of habitat by protection and more informed management of significant owl habitat (including protection of individual nest sites).

Impacts to the Powerful Owl have been considered within this document. The proposal does not involve the removal of significant owl habitat. The proposed development is considered

to be consistent with the objectives in that it will not decrease or fragment the extent of significant habitat.

DECCW has identified 21 priority actions to assist with the recovery of this species in New South Wales. Those relevant to this assessment include:

- Encourage private landholders to undertake management options to conserve and/or actively manage forest owl habitat; and
- Develop a sampling methodology stratified across different land tenures and disturbance histories, as well as a set of standardised regional monitoring protocols

The proposed development is consistent with these objectives; potential Powerful Owl foraging habitat will be retained on the subject site, and the methodology used to assess the likelihood of occurrence for the Powerful Owl satisfies this priority action.

(n) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The following Key Threatening processes are relevant to the Powerful Owl and Barking Owl:

- **Clearing of native vegetation** as this destroys populations of the species and their habitats.
- **Competition from feral honeybees** as this fauna species competes with native species for tree hollows;
- **Infection of native plants by *Phytophthora cinnamomi*** as vegetation that is utilised by this species may be susceptible and may be killed or damaged; and
- **Predation by the European red fox** as fledglings can become prey items for foxes.

The proposed development would result in the removal of potential foraging and roosting habitat for the Powerful Owl and Barking Owl, however several native trees will be retained across the site that will continue to provide foraging habitat.

The proposed development will not increase competition from feral honeybees for hollows as no hollows are proposed to be removed.

There are no signs that *Phytophthora cinnamomi* is currently impacting vegetation on the subject site and it is not likely that the process will be exacerbated as a result of the proposal.

Foxes are not likely to exist on the subject site and are not likely to be increased in number by the proposal.

Conclusion

A small area of potential foraging habitat (0.05 ha) for the Powerful Owl and the Barking Owl will be removed from the subject site. The local population of these species is predicted to remain viable within the locality. No significant impact is predicted to occur to the Powerful Owl or the Barking Owl as a result of the proposed development.

C.2.4 Grey-headed Flying-fox (Pteropus poliocephalus)

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is distributed along the east coast from Bundaberg in Queensland to Melbourne, Victoria. It occurs as far west as the western slopes of the Great Dividing Range in northern NSW. It occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Grey-headed Flying-foxes migrate according to the availability of native fruits, nectar and pollen. They roost in large "camps" which are generally within 20km of a food source (NSW NPWS 2001). The Grey-headed Flying-fox is listed as Vulnerable on Schedule 2 of the TSC Act (NSW Scientific Committee 2004d) (NSW Scientific Committee, 2004d) and under the EPBC Act.

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Grey-headed Flying-fox has previously been recorded flying over the subject site. Suitable foraging habitat occurs within the subject site, however there are no roosts. Flying-foxes roost in camps of thousands of animals at specific sites. The subject site is within 10 km of the Grey-headed Flying-fox camp site at the Ku-ring-gai Flying Fox Reserve in Gordon and therefore the Grey-headed Flying-foxes recorded flying over the subject site were likely to be from the Gordon camp. As the Grey-headed Flying-fox does not roost on the subject site, it is not likely that the proposal will affect the life cycle of these species such that a viable local population is placed at risk of extinction.

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

There are currently no populations of the Grey-headed Flying-fox listed as endangered under the TSC Act.

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

A small area of potential foraging habitat (0.05 ha) for the Grey-headed Flying-fox will be removed. This represents a small portion of the available habitat within the study area and wider locality.

Vegetation on the subject site will continue to be connected to adjacent stands of vegetation. The proposed development will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat. The Grey-headed Flying-fox is a highly mobile species and is capable of flying over developed areas in the locality. This is a highly mobile species and the impacts of the project are not expected to have a deleterious impact upon habitat corridors or habitat connectivity for dispersal of the species.

The subject site affords foraging habitat for the Grey-headed Flying-fox. As this species is highly mobile and moves around according to the availability of foraging habitat, it is likely to use a much broader area of habitat, including large areas of Lane Cove National Park and Ku-ring-gai National Park. Therefore the land affected by the proposal is not important habitat for this species. The removal and modification of the vegetation on the subject site is not likely to have an adverse effect on the long-term survival of these species.

(e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECCW.

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

No recovery plan for this species has been prepared by the NSW National Parks and Wildlife Service to date. The DECCW has identified 31 priority actions to help recover the Grey-headed Flying-fox in New South Wales. Actions relevant to the subject site include:

- Protect and enhance priority foraging habitat for Grey-headed Flying-foxes, for example through management plans, local environmental plans and development assessments, and through volunteer conservation programs for privately owned land; and

- Increase the extent and viability of foraging habitat for Grey-headed Flying-foxes that is productive during winter and spring (generally times of food shortage), including habitat restoration/rehabilitation works

Flowering trees will be retained and managed on the site, thus maintaining foraging habitat in the long term

No threat abatement plans are relevant to this species.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The following Key Threatening processes are relevant to the Grey-headed Flying Fox:

- Clearing of native vegetation as this destroys populations of the species and their habitats; and

- Infection of native plants by *Phytophthora cinnamomi* as vegetation that is utilised by this species may be susceptible and may be killed or damaged.

The proposed development would result in the removal of potential foraging habitat for the Grey-headed Flying-fox. Numerous flowering native trees will be retained on the site however, thus maintaining habitat for this species on the subject site.

There are no signs that *Phytophthora cinnamomi* is currently impacting vegetation on the subject site and it is not likely that the process will be exacerbated as a result of the proposal.

Conclusion

A small area (0.05 ha) of potential foraging habitat for the Grey-headed Flying-fox will be removed from the subject site. The local population of this species is predicted to remain viable within the locality. No significant impact is predicted to occur to the Grey-headed Flying-fox as a result of the proposed development.

C.2.5 Microchiropteran Bats

The following Assessments of Significance demonstrates apply to the following species of microchiropteran bats known to occur in the locality:

- Eastern Bentwing-bat (*Miniopterus oriane oceanensis*);

- Eastern Freetail-bat (*Mormopterus norfolkensis*);

- Greater Broad-nosed Bat (*Scoteanax rueppellii*);

- Eastern False Pipistrelle (*Falistrellus tasmaniensis*); and

- Large-eared Pied Bat (*Chalinolobus dwyeri*)

The Eastern Bentwing-bat occurs along the east and north west coasts of Australia. It roosts in caves, derelict mines, stormwater tunnels, buildings and other man-made structures. It forages above the canopy in forested areas. This species also can potentially roost in some rock crevices and overhangs (DECC (NSW) 2005). The Eastern Bentwing-bat forms maternity colonies in caves and populations usually centre on such caves (DECC (NSW) 2005). The Eastern Bentwing-bat is listed as Vulnerable on Schedule 2 of the TSC Act (NSW Scientific Committee 2004b).

The Eastern Freetail Bat occurs from southern Queensland to southern NSW, in dry sclerophyll forest and woodland. It roosts in tree hollows and sometimes under bark or in man-made structures (DEC (NSW) 2005b). The Eastern Freetail Bat is listed as Vulnerable on Schedule 2 of the TSC Act (NSW Scientific Committee, 2004c)(DEC (NSW) 2005b).

The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. The species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings (OEH, 2012). The Greater Broad-nosed Bat is listed as Vulnerable on Schedule 2 of the TSC Act.

The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. The species prefers moist habitats, with trees taller than 20 m. The species generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. The Eastern False Pipistrelle is listed as Vulnerable on Schedule 2 of the TSC Act.

The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. The species occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. It roosts mainly in tree hollows but will also roost under bark or in man-made structures (OEH, 2012). The Eastern Freetail-bat is listed as Vulnerable on Schedule 2 of the TSC Act.

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

There is very limited potential roosting habitat for the hollow-dwelling species of these microchiropteran bats on the subject site and no potential roosting habitat for cave-dwelling species. These species are likely to primarily utilise the subject site as foraging habitat as part of a larger range. A small area of potential foraging habitat will be removed, thus it is not likely that the proposal will affect the life cycle of these species such that a viable local population is placed at risk of extinction.

b) *In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,*

There are no populations of these species listed as endangered under the TSC Act.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Potential foraging habitat for microchiropteran bat species exists within the subject site, of which a small area of variable condition vegetation is proposed for removal. The area of native habitat to be removed represents a small portion of the available habitat within the study area and wider locality.

Vegetation on the subject site will continue to be connected to adjacent stands of vegetation. The proposed development will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat. All five species are highly mobile and are capable of flying over developed areas in the locality. Based on this, the impacts of the project are not expected to have a deleterious impact upon habitat corridors or habitat connectivity for dispersal of the species.

The subject site affords foraging habitat for microchiropteran bats. As this species is highly mobile and moves around according to the availability of foraging habitat, it is likely to use a much broader area of habitat. Therefore the land affected by the proposal is not important habitat for this species. The removal and modification of the vegetation on the subject site is not likely to have an adverse effect on the long-term survival of this species.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No critical habitat for these species has currently been identified by the Director-General of the DECCW.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plans have been prepared for these species. No threat abatement plans are relevant to these species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of a key threatening process.

The proposed development would result in the removal of potential foraging habitat for threatened microbat species. Open grassland and woodland areas will be retained and created on the site, maintaining the sites habitat.

There are no signs that *Phytophthora cinnamomi* is currently impacting vegetation on the subject site and it is not likely that the process will be exacerbated as a result of the proposal.

Conclusion

A small portion of potential foraging habitat will be removed from the subject site. Additionally, some small hollows providing potential roosting habitat will be impacted. It is not considered that the removal of this vegetation will have a significant adverse impact on the viability of this species on the subject site and within the locality, particularly in light of the limited clearing that will occur. The local populations of the species are predicted to remain viable within the subject site and adjacent vegetation.

Appendix D

Biodiversity Statement

D.1 Purpose

This Appendix presents a Biodiversity Statement that has been prepared to comply with the council requirement detailed within the Ku-ring-gai Council (2012) Pre-development Application Meeting Minutes: PRE0073/12 (185 Fox Valley Road, Wahroonga, NSW, 2076):

"*A biodiversity statement is to be provided to demonstrate compliance of the proposal with the management actions as per the approved Biodiversity Management Plan prepared by Cumberland Ecology Dated November 2010.*"

This statement details the ways in which the proposed development is consistent with the Biodiversity Management Plan (BMP) prepared by Cumberland Ecology (2010).

D.2 Methods

A review of the BMP was undertaken and management actions were identified and analysed. Plans relating to the development footprint, hydrology and civil design were reviewed, and checked for consistency with the management actions within the BMP.

D.3 Results

Table D.1 below details the management actions stipulated within the plan, and provides an assessment of whether the development is consistent with them. In some instances, management actions are currently being undertaken adjacent to the subject site. Examples of these are management of the APZ for fuel load, where fuel load level is reduced by the mechanical removal of groundcover and leaf litter, and weed management, where weeds identified within the BMP are being managed and removed. These will be continued following redevelopment of the subject site.

Table D.1 Assessment of Compliance with BMP

Management Objective	Management Plan Actions	Location	Compliance with BMP
Weed Management Plan		Weed Polygons Adjacent to Subject Site	Weed Polygons have been identified throughout the Wahroonga Estate to better target management actions. Weed polygons directly adjacent to the subject site include 15, 16 and 21.
Improve condition to <10% weed cover	Swath entire weed class 1 areas target all weeds. Target weeds; Small and Large Leaved Privet, Lantana, Blackberry, Ochna, African Olive, Wandering Jew etc.	16	Weed management is being undertaken by Australasian Conference Association, within this weed polygon. Weed management will be continued following the construction of the proposed development, thus the development is consistent with the management plan action.
Improve condition to < 30% weed cover	Target weeds; Lantana, Small and Large Leaved Privet, Exotic Grasses, Cassia and Blackberry and Jasmine	21	Weed management is being undertaken by Australasian Conference Association, within this weed polygon. Weed management will be continued following the construction of the proposed development, thus the development is consistent with the management plan action.

Table D.1 Assessment of Compliance with BMP

Management Objective	Management Plan Actions	Location	Compliance with BMP
Improve Weed Class 4	Target all weeds in preparation for revegetation. Target weed; Small and Large Leaved Privet, Lantana, Cassia, Blackberry, Exotic Grasses, Murraya, Flame Tree and Jacaranda.	15	Weed management is being undertaken by Australasian Conference Association, and has occurred within this weed polygon. The area has been prepared for planting. Weed management will be continued following the construction of the proposed development, thus the development is consistent with the management plan action.
Improve condition to < 5% weed cover	Swath entire weed class 1 areas Target all weeds. Target weeds; Small and Large Leaved Privet, Lantana, Blackberry, Ochna, African Olive, Wandering Jew etc	16	Weed management is being undertaken by Australasian Conference Association, and has occurred within this weed polygon. Weed management will be continued following the construction of the proposed development, thus the development is consistent with the management plan action.
	Target secondary weeds and regenerating keystone weeds. Target weeds; Lantana, Small and Large Leaved Privet, Cassia and Blackberry and Jasmine	21	Weed management is being undertaken by Australasian Conference Association, and has occurred within this weed polygon. Weed management will be

Table D.1 Assessment of Compliance with BMP

Management Objective	Management Plan Actions	Location	Compliance with BMP
			continued following the construction of the proposed development, thus the development is consistent with the management plan action.
	Target secondary weeds and regenerating keystone weeds. Target all weeds in preparation for revegetation. Target weed; Small and Large Leaved Privet, Lantana, Cassia, Exotic Grasses, Blackberry, Exotic grasses, Murraya, Flame Tree and Jacaranda	15	Weed management is being undertaken by Australasian Conference Association, and has occurred within this weed polygon. Weed management will be continued following the construction of the proposed development, thus the development is consistent with the management plan action.
Maintain weed cover < 5%	Periodic weed sweeps throughout entire E2 zone. Monitor revegetation sites. Target known weed sources – stormwater outlets, creeks, entry points, interface. Quadrats and photo monitoring annually.	All polygons	Weed management is being undertaken by Australasian Conference Association, and has occurred within this weed polygon. Weed monitoring will occur throughout the Wahroonga Estate. Weed management will be continued following the construction of the proposed development, thus the development is consistent with the management plan action..

Table D.1 Assessment of Compliance with BMP

Management Objective	Management Plan Actions	Location	Compliance with BMP
Vegetation Management Plan			
APZ's	Weed control efforts should aim to target known invasive species. All native trees will be retained. If native canopy trees die, they will be replaced by trees of the same species.	APZ	Weed management is being undertaken by Australasian Conference Association, and has occurred within the APZ adjacent to the subject site. Native tree replacement will occur where required. Weed management will be continued within the APZ, during and following construction, thus the development is consistent with the management plan action.
STIF			
Inappropriate Fire Regimes	Fuel reduction as part of bushfire management must be considered as the vegetation is bushfire prone and adjacent urban development.	APZ	Fuel load reduction is being undertaken by Australasian Conference Association, and is occurring within the APZ adjacent to the subject site. Fuel load reduction will be continued during and after construction of the proposed development.
Precautions against *Phytophthora*	Sanitation of tools, machinery, boots and tyres must be undertaken. Infected vegetation must be	STIF	Phytophthora controls will be communicated to machinery

Table D.1 Assessment of Compliance with BMP

Management Objective	Management Plan Actions	Location	Compliance with BMP
	disposed of offsite.		operators and construction staff working within the site.
Weeding	Weed management is to occur in accordance with the weed management plan	STIF	Weed management is being undertaken by Australasian Conference Association in accordance with the Weed Management Plan.
Revegetation	Mulching and supplementary planting to be undertaken in APZ's	Area 4	Primary weeding is still occurring within this area. Mulching and supplementary planting will occur in the future within this zone..
Fire Management Plan			
APZ's	Lands within the Wahroonga Estate, up to the boundary of the E2 Zone are to be managed as an APZ of 20-50 m.		
Inner Protection Area	Check fire protection measures to buildings. Clean roof gutters separation between trees & buildings; maintain limbs 2m clear of ground & shrubs. Minimise Fine Fuels, Minimise the accumulation of combustible fuels and accumulated ground litter	Inner Protection Area	Site is currently managed as an inner protection area. Site will be managed as an Inner Protection Area during and following construction. Regular landscaping maintenance will take place to ensure fuel load is kept low.
Outer Protection Area	Maintain fine fuels at < 8 tonnes/hectare	Outer Protection Area	Outer protection area is currently

Table D.1 Assessment of Compliance with BMP

Management Objective	Management Plan Actions	Location	Compliance with BMP
			managed for fuel load. OPA will undergo ongoing fuel reduction management and bush regeneration activities to maintain low fuel load
Pest Management Plan			
Plague Minnow	Minimise human dispersal of the Plague Minnow through public education; and minimise the introduction of Plague Minnow into the natural environment.	Subject Site	Invasion of the plague minnow will not be exacerbated by the proposal. The proposal will not introduce the species into the natural environment
Bird Species	Prevent access to food in rubbish bins by modifying the design or by ensuring that a lid is attached and used and avoid providing nectar resources within landscaping such as Callistemon and hybrid Grevillea.	Subject Site	Bins are currently utilised throughout the site. Bins will be utilised throughout the site, and flowering species to be kept to a minimum in plantings.
Rodents	Rubbish to be contained in bins	Subject Site	Bins are currently utilised throughout the site, and will be utilised throughout the site in the future.
European foxes	Maintain canopy connectivity within bushland to allow arboreal fauna movement	E2 Zone	Canopy connectivity has been retained and will not be impacted by the development.
Feral Cats	Prevent access to rubbish bins	Subject Site	Rubbish bins are currently utilised on the site. Rubbish bins will be utilised throughout the site, and will

Table D.1 Assessment of Compliance with BMP

Management Objective	Management Plan Actions	Location	Compliance with BMP
			be of a design suitable to exclude feral cats.
Feral Dogs	Prevent access to rubbish bins	Subject Site	Rubbish bins will be utilised throughout the site, and will be of a design suitable to exclude feral dogs.
Habitat Corridors and Linkages Management Plan			
Protect the ecological values of the Coups Creek and Fox Valley Road corridors	Retention of all native vegetation within the E2 zone	E2 Zone	The development will retain all native vegetation within the E2 Zone adjacent to the site.
Minimise the impacts of the proposal within the subject land on Coups Creek and Fox Valley Road corridors during construction and development of adjacent residential areas	Management of pests and weeds within the Coups Creek and Fox Valley Road corridors as prescribed in the pest and weed management plans for the subject land	Whole site	Pests and weeds are being managed appropriately as per the pest and weed management plans. Rubbish bins will be implemented on the site, and weeds are being managed within the vegetation adjacent to the site
Maintain biodiversity and protect native flora and fauna species (including threatened species) and habitats.	Bushfire management of APZ's adjacent to the Coups Creek and Fox Valley Road corridors within the subject land in accordance with the attached Fire Management Plan	APZ's	APZ adjacent to the site will be maintained and managed as per the Fire Management Plan
	Exclusion fencing along the boundaries of the Coups Creek and Fox Valley Road corridors	Vegetation Boundary	Fences will be installed following development

Table D.1 Assessment of Compliance with BMP

Management Objective	Management Plan Actions	Location	Compliance with BMP
	within the subject land.		
Hydrology and Nutrient Management Plan			
Construction-stage Stormwater Management	Limit soil disturbance within the development site where possible	Subject Site	Soil disturbance has been minimised where possible. To further avoid soil disturbance appropriate erosion and sediment control measures will be put in place throughout the construction
	Minimise soil erosion resulting from the construction activities over the precinct development site	Subject Site	Appropriate erosion and sediment controls will be put in place surrounding the site throughout construction
	Protect downstream environments from sedimentation.	Subject Site	Appropriate erosion and sediment controls will be put in place surrounding the site throughout construction
Management of Stormwater Discharges	Disperse all stormwater runoff entering the bushland sufficiently so as not to cause downstream erosion or scour. This can be achieved using a dispersal trench when the soil and geotechnical conditions are suitable.	Subject Site	To limit erosion and scour within the bushland downstream, the stormwater will be collected in an On Site Detention tank, and discharge from the OSD tank is proposed to be released through a 500mm x 800mm x 6000mm dispersion trench.

Table D.1 Assessment of Compliance with BMP

Management Objective	Management Plan Actions	Location	Compliance with BMP
Water Sensitive Urban Design Measures	Pollutant removal through processes such as screening, sedimentation, filtration and subsequent chemical and biological transformation of captured pollutants;	Subject Site	The permanent stormwater system will include a water quality treatment train consisting of rainwater reuse, on-site detention with a trash screen at the outlet and stormwater treatment device proprietary
	Stormwater capture and reuse, mainly for non-potable water demands within the development;	Subject Site	The proposed stormwater design includes 80m3 of rainwater reuse storage. The reuse design will include plumbing to toilets and to the irrigation system.
	Temporary detention of flows	Subject Site	The proposed design includes a 250 m2 On Site Detention to temporarily slow flows.
	Promote stormwater infiltration into the natural ground	Subject Site	The design incorporates soft landscaped areas which will provide ground infiltration, and water will be dispersed to the soil through the dispersion trench.
Non-structural Stormwater Management Measures	Development incorporates best practice WSUD measures to mitigate the impact of increasing the development's impervious areas	Subject Site	WSUD has been incorporated into the project design through rainwater detention tanks, stormwater detention tanks, filtration of released

Table D.1 Assessment of Compliance with BMP

Management Objective	Management Plan Actions	Location	Compliance with BMP
			stormwater, implementation of dispersion trenching and the reuse of rainwater on site.
	Community Education and Participation	Subject Land	Drain stencils and information to be distributed by Australasian Conference Association throughout the redevelopment of the Wahroonga Estate
	Council Management Activities	Subject Land	Council to incorporate consideration of stormwater impacts when undertaking works outside of site boundaries

D.3.1 Weed Management Plan

The vegetation to the east of the subject site, including the APZ and E2 Zone are currently undergoing weed management, which will continue following the development of the site. Additionally, controls will be put in place throughout the construction period to limit stormwater movement offsite, thus alleviating the potential for weed movement via stormwater into the adjacent vegetation. The development is consistent with the weed management plan.

D.3.2 Vegetation Management Plan

The vegetated areas surrounding the development are currently undergoing weed and fuel load management, which will continue following the development of the site. *Phytophthora* protocols for the site will be communicated to construction site staff and machinery operators. The development is consistent with the vegetation management plan.

D.3.3 Fire Management Plan

The APZ surrounding the site is currently fuel managed, and this will continue into the future following redevelopment of the site. Fuel loads within the inner and outer protection areas will be maintained by grounds staff below levels stipulated within the fire management plan. The development is consistent with the fire management plan

D.3.4 Pest Management Plan

As recommended within the BMP, bins will be utilised throughout the development, ensuring that rubbish is not available to feral species such as rodents, birds, dogs or cats. The development is consistent with the management actions detailed within the Pest Management Plan.

D.3.5 Habitat Corridors and Linkages Management Plan

The proposed development will not impact on the ability of the vegetation adjacent to the site to act as a habitat corridor and will not fragment the vegetation patch. The development will not impact on the ecological values of the Coups Creek and Fox Valley Road corridors. The development is consistent with the management actions detailed within the Habitat Corridors and Linkages Management Plan.

D.3.6 Hydrology and Nutrient Management Plan

The hydrological design of the development is consistent with the Hydrology and Nutrient Management Plan. The design includes recommendations from the BMP such as the use of onsite rainwater detention, on site stormwater detention, re-use of rainwater on site for plumbing and gardening purposes and the installation of a water dispersion trench to disperse excess stormwater water evenly throughout the landscape and avoid erosion.

D.4 Conclusion

The development is broadly consistent with the approved BMP. Actions detailed within the plan such as weed and fuel management are already being undertaken and will continue to be undertaken in the vegetation adjacent to the subject site. Additional recommendations within the BMP such as the use of onsite water detention basins, gross pollutant traps, water dispersion trenches and garbage bins will be implemented.